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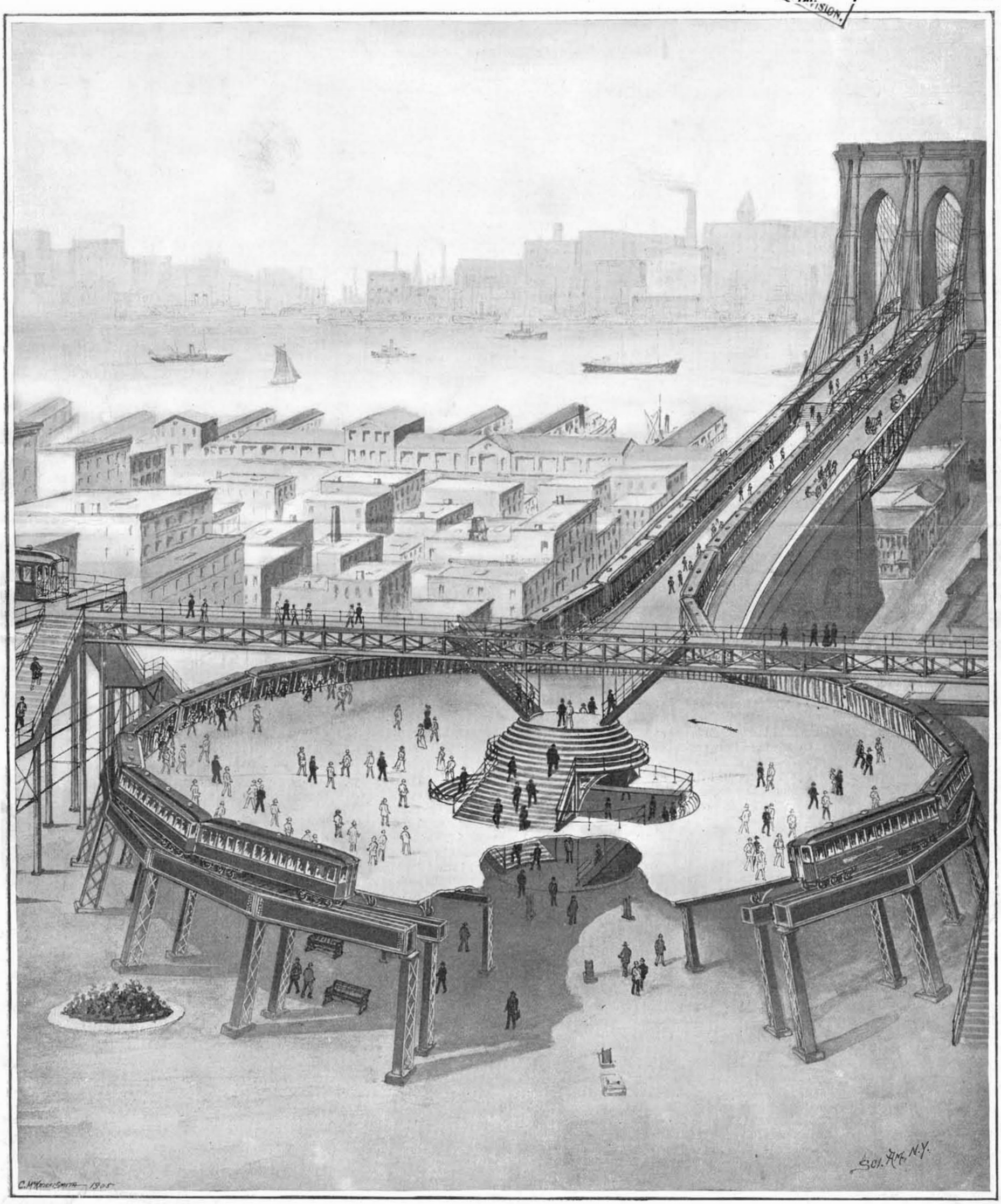
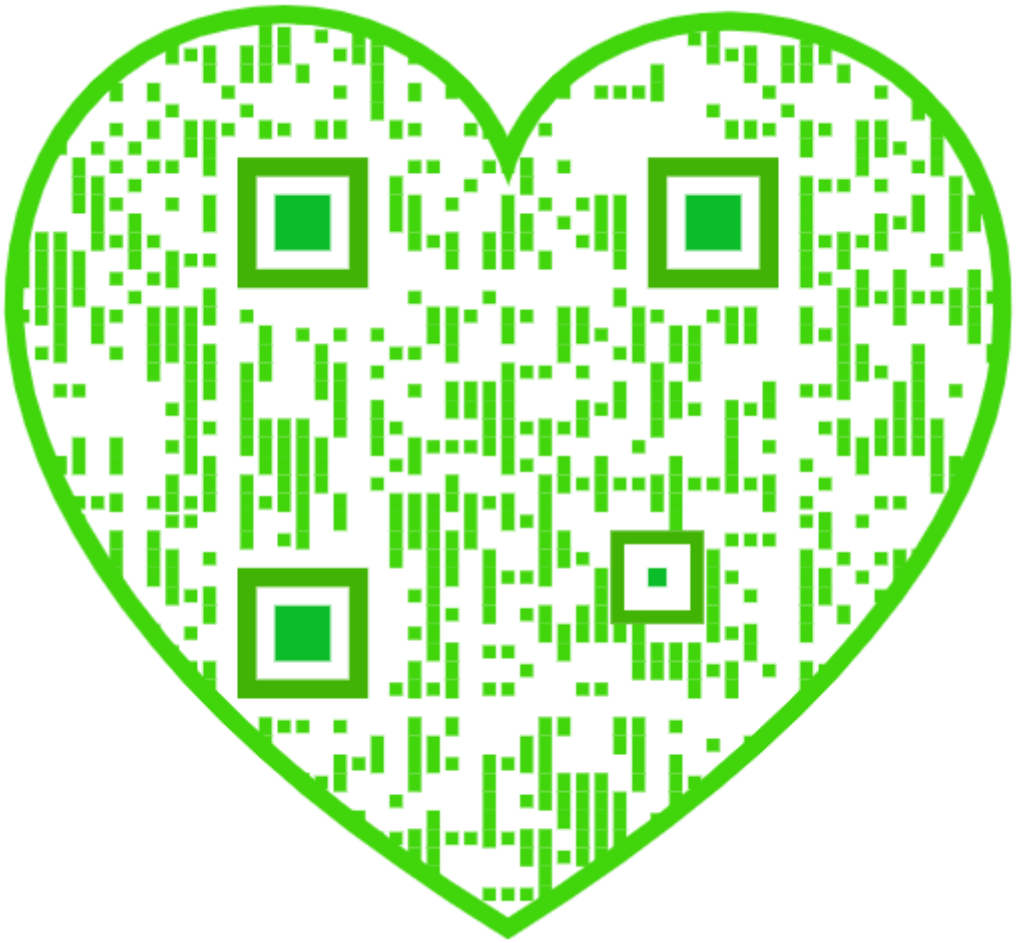


An endless train of light cars running across the bridge and around a loop at each end. Each station consists of a circular, saucer-shaped platform 400 feet in diameter, the outer edge forming chords of a circle, each equal to the length of a car. The cars lock with this platform and turn it. The cars and the outer edge of platform move at 20 miles an hour. The passengers alight and embark through side doors, one to each seat. Entrance to the platform is at the center by stairways, whose lowest steps move at a speed of one mile per hour. There are no stops, the system running continuously.

A Design for Relieving the Congestion and Increasing the Capacity of the Terminals and Trains.

PROPOSED ENDLESS-TRAIN LOOP AND ROTATING STATION FOR BROOKLYN BRIDGE.—[See page 222.]



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NEW YORK, SATURDAY, MARCH 18, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LAKE ERIE AND THE NEW YORK WATER SUPPLY.

We have had brought to our notice the general outlines of a scheme for providing a source of water supply that would meet the present and future needs of New York city. We present this scheme here in its broad outlines as being an interesting, and not impracticable, study of a problem which is pressing for solution with an emphasis that increases as the years go by. It is suggested that in the vast body of fresh water, Lake Erie, there is an unfailing supply of good drinking water which can be tapped at an elevation of 580 feet above the sea level. The lake is about 300 miles distant from New York city, and it is suggested that, because of this difference of level, by the construction of a suitable aqueduct or aqueducts this water could be brought to New York city, and delivered under a pressure, approximately, of 200 pounds to the square inch, which is 50 pounds more than the highest pressure under which water is now delivered in the most favored portions of the city. Beginning at Lake Erie, the proposal is to build a suitable intake, which would discharge the water into ducts of steel and concrete construction, the steel furnishing the necessary tangential strength to resist the considerable water pressure. It is proposed to take advantage of the reconstruction of the Erie Canal and lay the ducts along the canal right of way, carrying out this work contemporaneously with the enlargement of the canal. At Schenectady the ducts would leave the canal and be carried in an approximately straight line to New York city. In view of the extraordinary rate at which the population of the city is increasing, the ducts would be built of sufficient size for the delivery of a maximum supply of one billion gallons of water a day, should that amount be ultimately required. The structure would be placed beneath the ground, at a sufficient depth to protect it from injury; and for the greater part of its length, after leaving Schenectady, it would follow the undulations of the ground, and involve a minimum amount of tunneling.

To accomplish the necessary reduction in pressure for city use, both in New York and at the various towns along the route which would also be served by the aqueducts, the water, at points of suitable fall, would be carried through waterwheels, and the power thus generated would be a valuable asset. The passage of the water through waterwheels would accomplish the following result: First, it would reduce the pressure; second, it would aerate the water; and third, it would serve to generate power which could be used for municipal lighting for pumping sea water for fire service, and for other city purposes.

It is suggested that this proposition be intrusted to a competent State commission, with power to regulate the water supply and sewage of any city in the State having 100,000 inhabitants or more, making it optional for smaller cities to be included at their request. It is claimed that by making the question of the water supply, not merely of New York but of the cities that lie within reach of the proposed aqueduct, a State matter, and by carrying it through on the broad lines suggested, the whole question would be simplified, the expense per capita reduced, the cities affected connected with a vast natural reservoir of cold, pure water, placed, as if for the purpose, on the very borders of the State, and that thereby the whole miserable business of the Ramapo water company and other complications of the kind would be swept out of the way for good, and this, the most important question affecting the welfare not merely of New York city but also the other leading cities of the State, settled once and forever.

Among the many plans for water supply that have been suggested during the past few years, this is one which seems to be worthy of more than casual consideration.

The correspondent who sent to this office the pamphlet containing the above suggestions is one of the minority who consider that it is inexpedient to carry out the enlargement of the present Erie Canal, on the ground, presumably, that to render the canal efficient it should be built to a much greater depth than 12 feet. He suggests that rather than spend over a hundred million dollars in deepening the canal, it would be wise to abandon the canal as such, and utilize the present bed for the construction of the proposed aqueducts. At present the canal is 56 feet wide at the bottom, 70 feet wide at the surface, and about 7 feet in depth, which would, with some dredging, provide ample cross section to contain ducts of a total capacity of one billion gallons per day. Although this scheme is impossible for the reason that the State is committed to the widening of the canal, the point is certainly well made that, if the construction of such an aqueduct line were carried on simultaneously with the canal enlargement, considerable economy of construction would be realized.

THE TEMPERING OF BRONZE.

M. Leon Guillet has lately made some experiments as to the effect of tempering upon bronzes. It is known that some kinds of bronze are softened by tempering. On the other hand, M. Riche showed that bronzes which contain a considerable proportion of tin, 15 to 20 per cent, are malleable when hot, while they are brittle when cold. The experimenter wished to find the influence of tempering upon the mechanical properties, using different specimens of metal. To carry this out he submitted bronzes having from 5 to 21 per cent of tin to a tempering which varied in different cases from 300 to 800 deg. C. He draws the following conclusions from these tests. 1. Alloys containing more than 92 per cent copper have their breaking strain increased somewhat by tempering at a low temperature between 400 and 600 deg. The elongation varies in about the same way. 2. For metals containing less than 92 per cent copper, the breaking strain and elongation increase in marked degree when the temperature of the tempering exceeds 500 deg. The maximum breaking strain is reached for all the specimens for a tempering carried out at about 600 deg. On the contrary, the maximum of the elongation seems to vary with the composition of the alloy. It occurs at a tempering of 800 deg. for the bronze containing 81 per cent copper and 19 tin, and at 600 deg. for 79 copper and 21 tin. The difference between the breaking strain of the non-tempered cast metal and the pieces which are tempered at the most favorable temperature is greater according as the proportion of copper is smaller. In general it is to be concluded that the tempering of bronze between 600 and 800 deg. C. brings about much better results as to traction tests. As to the resistance to friction, the effect is to be studied in the further experiments.

SUBURBAN TRAFFIC IN LONDON.

The suburban traffic of the railroads of London has suffered severely from the competition of the street electric railroads of the County Council. The decrease in the number of passengers carried during the past year has amounted in one instance to as many as 2,100,000. In order to combat the effect of this competition, the London, Brighton, and South Coast Railroad have decided to convert a section of their suburban road between Battersea and Peckham Rye, which extends through thickly-populated districts, to electricity. This electrification scheme is the first installment of a complete transformation of the whole of the suburban roads. Owing to the many disadvantages and dangers attending the adoption of the third rail, a single-phase alternating-current system with overhead conductors is to be employed, such as is already in operation on railroads for the local services at Hamburg and Berlin, and similar lines running in Belgium, Bavaria, and Austria. Bare overhead wires and a single high-tension conductor are to be employed. The advantages of this system are greater economy, both in the cost of installation and expense of working and maintenance, since currents can be generated and distributed directly to the overhead conductor without requiring any transformation, thereby dispensing with the erection and maintenance of sub-stations, as well as obviating the losses of energy due to the transformation. The rapid acceleration of electrically-operated trains is so important a factor, that the average speed of suburban trains can be nearly doubled. Moreover, the use of trains with motor coaches at either end makes the total time occupied in getting in and out of a terminus much less than that required for steam trains.

BACTERIAL SOIL INOCULATION FOR VEGETABLES.

The recent announcement in these columns that Dr. George T. Moore, of the United States Department of Agriculture, had dedicated to the public his patents on soil inoculation with bacteria, attracted attention to the results of his work.

The primary object of this investigation of the fixation of nitrogen by the root nodules of legumes was to devise, if possible, some method of bringing about the artificial introduction of the necessary organisms into a soil which was naturally devoid of them, and at the same time to attempt as far as possible to correlate and reconcile the vast amount of conflicting evidence that has been accumulated by various investigators, in regard to the exact nature of the organism where the nitrogen is fixed, the effect upon the host, and similar problems.

The actual benefit of the presence of root nodules upon various leguminous plants has been thoroughly demonstrated by numerous observers both in this country and abroad. The early work of Helriegel and Willfarth, together with that of Lawes and Gilbert, and of Warington in England, and of Atwater and Woods in this country, was quite sufficient to demonstrate the close connection between the fixation of nitrogen in some way by the plant and the presence of the tuber-like swellings on its roots, and there are few, if any, who would maintain that this peculiar function is not under most circumstances distinctly beneficial.

Hundreds of examples can be cited, demonstrating the great benefit which a leguminous crop has upon the succeeding crop. From these we can easily see that it is the almost universal belief, as the result of definite experiments, that a leguminous crop is equal to a considerable amount of nitrogenous fertilizer, and that the crop which follows the legume is benefited to a marked degree. It has been found, however, that although in a great many instances the organisms producing nodules are naturally abundant in the soil, and the mere planting of the legume seed is sufficient to produce a crop capable of fixing nitrogen, there are also some localities which are devoid of the necessary bacteria, and in such places the leguminous crop is of no more benefit to the soil than the corn or wheat or other crops, whose yield might be a greater source of revenue.

It therefore has become necessary to devise some means of artificially introducing into the soil the nodule-producing bacteria, and naturally the simplest means of accomplishing this has been to transfer earth known to contain the proper organisms and capable of producing nodules, to the fields where it was desirable to introduce such bacteria. This soil inoculation method is one which has been practised widely both in this country and abroad, ofttimes with the best results, but not with universal success. In order to escape the difficulties involved in the above-mentioned method, Nobbe conceived the idea of bringing about inoculation by means of pure cultures. This was to be accomplished by isolating from the nodule, by means of a gelatine plate, the right organisms and then transferring to tubes or bottles containing nutrient agar. To this culture of nodule-forming bacteria was given the trade name of "nitragin." Seventeen different kinds of nitragin were prepared from the nodules of as many different plants, and arrangements were made to have them put up on a large scale and placed upon the market by a well-known firm of manufacturing chemists. Experiments with nitragin in Germany met with varying degrees of success. In some instances its use seemed to produce an abundant formation of nodules, while in other cases no benefit could be obtained. In this country the results were very uncertain. Consequently, even though this preparation has been found to be satisfactory in Europe, the necessity for devising some method of producing nitrogen-fixing nodules, free from the objectionable features of transferring soil, remains the same. For this reason, the Laboratory of Plant Physiology of the Department of Agriculture undertook a scientific investigation of the root-nodule organism, and as a result it is believed that a thoroughly practical and satisfactory method of bringing about artificial inoculation has been devised.

There has been the widest difference of opinion as to the morphology and life history of these bodies. It has been determined that the nodule-forming organism is a true micro-organism having three well-defined stages, consisting (1) of minute motile rods which produce the infection, and frequently form zoogloea masses; (2) larger rods either motile or non-motile, and (3) capsulated forms, the so-called "branched organisms," which are made up of two or more rods held together in a sheath. Further, there is but one species of legume organism—*Pseudomonas radicicola* (Beyerlinck) Moore. The difference in the infective power of bacteria from different posts is due to slight physiological variations, which can be broken down readily by cultivation.

The usual method of growing a nodule-forming organism has been to make a medium from a decoction of the particular legume upon which the organism originally grew. As a result of numerous trials, however, it has been found that although the bacteria increased most rapidly upon a medium rich in nitrogen, the resulting growth is usually of very much reduced virulence, and when put into the soil these organisms have lost the ability to break up into the minute forms necessary to penetrate the root hairs. They likewise lose the power of fixing atmospheric nitrogen, which is a property of the nodule-forming bacteria under certain conditions. This condition was met by using an agar for plating out from the nodule to which no nitrogenous salt was added, the usual combination being 1 per cent agar, 1 per cent maltose, 0.1 per cent monobasic potassium phosphate, and 0.02 per cent magnesium sulphate to 100 cubic centimeters of distilled

water. While such a medium is not, of course, absolutely devoid of fixed nitrogen, the percentage is so much less than that found in a legume extract-peptone combination, that the results are quite satisfactory. Silica jelly was also used as a solid base to which the above salts were added, giving a culture medium as free from nitrogen as could be obtained.

Various external conditions, such as heat, moisture, alkalinity, amount of nitrogen in soil, etc., all have a direct effect upon the legume bacteria, and the failure of nodules to develop may often be traced to such causes.

After it was definitely established that the legumes were actually able to obtain free nitrogen from the atmosphere, naturally the next question was in regard to where and how this gas was fixed. Numbers of theories have been advanced by various scientists, but it has now come to be generally accepted, after exhaustive experiments and investigations, that the nitrogen is fixed by the bacteria in the nodule, and becomes available by the action of the plant in dissolving and absorbing the combined nitrogen in these organisms.

Painful as it may be to disturb one of Nature's mutual-benefit societies, there seems to be no other way than to consider the nodule-forming bacteria as true parasites, which penetrate the roots of the plant for the purpose of obtaining the necessary carbohydrates for food. Fortunately for the host plant, there are certain conditions under which it can overcome the bacteria and consume them, thus obtaining a considerable amount of nitrogenous food which would not otherwise have been available. The only co-operation between bacteria and host seems to consist in the microbe having the best of the situation at first, when it is able to secrete substances injurious to the cells of the legume, and later the host plant retaliates by secreting still other substances which result in the complete destruction of most of the bacteria.

The Department of Agriculture has distributed samples of cultures very widely for experimental purposes, with some very interesting results. One of the most striking effects reported by some careful observers was the apparent beneficial action of the culture without the formation of nodules. As the result of the careful microscopical examination of the roots, it was found that although no nodules were evident—in fact, did not exist—the cells within the smaller roots were packed with the characteristic branching forms of *Pseudomonas radicicola*, and that undoubtedly the plant was able to obtain considerable benefit from the presence of these organisms.

Even though the efficiency of the culture be at its highest point, the mere fact of its having to grow for a considerable time under artificial conditions is apt to weaken it. Consequently, the means of preserving and distributing the bacteria after they are propagated are fully as important as the method of obtaining them in sufficient quantity for distribution. If it had not been possible to devise a satisfactory way of delivering these organisms to the farmer, it is probable that but little success could ever have been obtained by the pure culture method. Fortunately, the large rods will withstand desiccation for a year or more, and therefore, because they may be sent dry any distance, and upon being revived be in the same condition of efficiency with which they started, the problem becomes a very simple one.

The method which has been employed in the Department of Agriculture for the past year has been to saturate absorbent cotton in a liquid culture of the organism. In this way millions of the bacteria are held within the cotton, and after this is carefully dried out, they remain dormant in it. It is difficult, when preparing to treat large quantities of seed, to prevent the entrance of other bacteria, molds, yeast, etc., all of which may have a deleterious effect upon the growth of the organism. For this reason it has seemed best to prepare the water in such a way as will facilitate the growth of the desired bacteria, and yet delay or prevent the development of the form which might be introduced from the outside, and consequently, two packages of nutrient salts have been distributed with the cotton culture.

AN IMPORTANT DISCOVERY IN THE PURIFICATION OF CONTAMINATED WATER.

The necessity of finding some cheap and practical method of preventing or removing algal contamination of cress beds first led the Department of Agriculture to undertake an investigation of the matter. The success of the first experiments in 1901 was so marked that it seemed wise to extend the work, and authority was, therefore, granted by Congress "to study and find methods for preventing the algal and other contaminations of water supplies."

The progress of the investigation has been noted from time to time in the annual reports of the Bureau of Plant Industry. Though the work is not yet completed, the results already obtained have been published for the consideration of boards of health and officers in charge of public water supplies.

Dr. Moore and Mr. Kellerman, the officials in charge of the work, have shown that it is entirely practicable cheaply and quickly to destroy objectionable algæ in small lakes, ponds, storage reservoirs, and other similar bodies of water by the use of extremely dilute solutions of copper suphate or of metallic copper. The fact that an extremely dilute solution (one to one hundred thousand) will also destroy the most virulent typhoid and cholera bacteria at ordinary temperatures in three hours is of great importance and significance. Solutions of copper as dilute as this are not considered injurious to man or other animals. The value of copper, especially colloidal, in preventing or treating typhoid and other related diseases should be carefully investigated by competent pathologists.

The investigators state that, so far as bacterial contamination of water is concerned, the methods proposed are not to take the place of, but are simply to supplement the standard methods of filtration; neither can too much stress be laid upon the importance of using boiled water for drinking purposes when taken from a contaminated source.

Upon application to the Department of Agriculture by proper authorities, information and assistance will be furnished in determining the organisms causing the trouble in cases of algal pollution, and the proper treatment will be recommended.

The conclusions drawn by the investigators are the following:

The disagreeable odors and tastes so often present in drinking water are due almost exclusively to algæ, although the economic importance of studying these plants has not been recognized until recent years.

These algal forms are widely distributed, and reservoirs in many States have been rendered unfit for use by their presence.

The methods now known for preventing or removing the odors and tastes caused by algæ have proved unsatisfactory, either because of prohibitive expense or failure to accomplish result.

It is therefore desirable that some new, cheap, harmless, and effective method be devised for ridding reservoirs of these pests.

It has been found that copper sulphate in a dilution so great as to be colorless, tasteless, and harmless to man, is sufficiently toxic to the algæ to destroy or prevent their appearance.

The mode of application makes this method applicable to reservoirs of all kinds, pleasure ponds and lakes, fish ponds, oyster beds, watercress beds, etc. It is also probable that the method can be used for the destruction of mosquito larvæ.

At ordinary temperatures 1 part of copper sulphate to 100,000 parts of water destroys typhoid and cholera germs in from three to four hours. The ease with which the sulphate can then be eliminated from the water seems to offer a practical method of sterilizing large bodies of water, when this becomes necessary.

The use of copper sulphate for the prevention of disease is regarded as incidental and is not designed in any way to supplant efficient preventive measures now in use. It is believed, however, that up to this time no such satisfactory means of thoroughly, rapidly, and cheaply sterilizing a reservoir has been known. Since the selective toxicity of copper sulphate renders it fatal to pathogenic forms peculiar to water, while the saprophytic or beneficial bacteria are unaffected, the method is particularly well adapted for this purpose.

Definite knowledge in regard to what organisms are present, the constitution of the water, its temperature, and other important facts are necessary before it is possible to determine the proper amount of copper sulphate to be added. A microscopical examination thus becomes as important as a bacteriological or chemical analysis.

No rule for determining the amount of copper sulphate to be added can be given. Each body of water must be treated in the light of its special conditions.

The cost of material for exterminating algæ will not exceed 50 to 60 cents per million gallons and will usually be less. The destruction of pathogenic bacteria requires an expenditure of from $5 to $8 per million gallons, not including the cost of labor.

THE WHISPERING GALLERY IN THE CAPITOL AT WASHINGTON.

BY WALLACE C. SABINE.

It has recently come to the writer's attention that one of the most curious and in its way famous architectural features of Washington, the whispering gallery in the old House of Representatives, now the Hall of Statues, has been unintentionally destroyed. It became necessary to replace the old ceiling, which was of wood, by a new ceiling. In order to preserve the whispering gallery, a feature which always interested visitors, the superintendent of the building, who was in charge of the reconstruction, had measurements made of the dimensions of the old ceiling and reproduced them as accurately as possible in the new. Notwithstanding this care the whispering-gallery property of the room almost entirely disappeared, and since then the fact has been frequently cited as another of the mysteries of architectural acoustics and a disproof of the possibility of predicting such phenomena. So far, however, from being either a mystery or a disproof of the accuracy of the scientific considerations in dealing with architectural acoustics, this disappearance of the whispering gallery is exactly the opposite, and was in fact predicted by the writer two years before in the American Dictionary of Architecture. Under the head of "Whispering Galleries" the dictionary being published in 1899, is the following paragraph:

"Whispering galleries are usually accidental, but may without difficulty be predetermined. There are two general types—focusing and conducting. In the one the sound diverging from the source is received upon some concave reflecting surface, and is concentrated again at the conjugate focus. One of the best and most accessible examples of this type is the Hall of Statues, the old chamber of the House of Representatives, in the Capitol at Washington. The ceiling of this is a very considerable portion of the surface of a sphere whose center is near the floor. Standing at the center of this sphere one can hear his own whisper returned to him. Standing at one side of this point he can whisper, especially if he turns his face toward the ceiling, to a person standing at a great distance on the other side of the center. For any position of the speaker there is a corresponding point at which the whisper is more or less accurately focused. *The ceiling, painted so that it appears deeply paneled, is smooth. Had the ceiling been paneled, the reflection would have been irregular, and the effect very much reduced.* The most accurate form for a whispering gallery is that in which the reflecting surface is a very considerable portion of the surface of an ellipsoid, that has for its foci the two points between which there is to be communication."

The above, written before any changes were contemplated, exactly covers the case. The new ceiling differs from the old in two respects. Instead of being of wood it is of plaster on iron supports. This alone would produce no deterioration in the whispering gallery, for plaster on iron is an even better reflector than wood. But plaster as now handled admits of an architectural treatment to which it did not formerly so readily lend itself, and the coffering which was but painted on the old ceiling is copied in relief on the new, with the result that it ceases to be in any way a remarkable whispering gallery. So far from being a disproof of the possibility of prediction in architectural acoustics it is, as far as a single case can be, a confirmation of its reasonable accuracy, and in this particular case of its entire accuracy.

It is not difficult to explain the basis for the prediction that coffering the ceiling would have this effect. The focusing of the sound by the concave ceiling is in every respect similar to the focusing of light by a concave mirror. Just as scratching the mirror dims the image of light, so paneling the reflecting wall dims the focused whisper, for a panel, a pilaster, or a column on a wall surface is to sound what a scratch on the surface of a mirror is to light. That in the case of light the scratches may be so fine, while in the other cases the "scratches" must be of the dimension of columns and pilasters, is because of the relative wave lengths of light and sound. The wave length, that which corresponds to the distance from crest to crest in a water wave, is in the case of light about one fifty-thousandth part of an inch, while in the case of sound it is for the ordinary tones of a man's voice several feet. For this reason a column or a pilaster of vast magnitude bears to the sound of a man's voice the same relation that the merest scratch bears to light. We thus have the great acoustical mirror of the Hall of Statues now dimmed by the coffering which breaks the formerly smooth surface. To this argument it may be, in fact it has been, objected that while the waves of sound of a man's voice are several feet in length this coffering is of but a few inches in depth, and therefore insufficient. The answer to this is that while the full rounded tones of a man's voice and for that matter, though to a less degree, of a woman's voice, are of long wave length, a whisper by either man or woman is of a very different character. The component tones of a whisper are very high and of very short wave length, so that irregularities that would not disturb the focusing of the full tones of the voice will utterly ruin a whispering gallery.

The loss of the whispering gallery is of course only the loss of an architectural curiosity. It was, however, remarkably perfect, and so interesting and even famous as to be well worth the well-intentioned but misdirected efforts for its preservation.

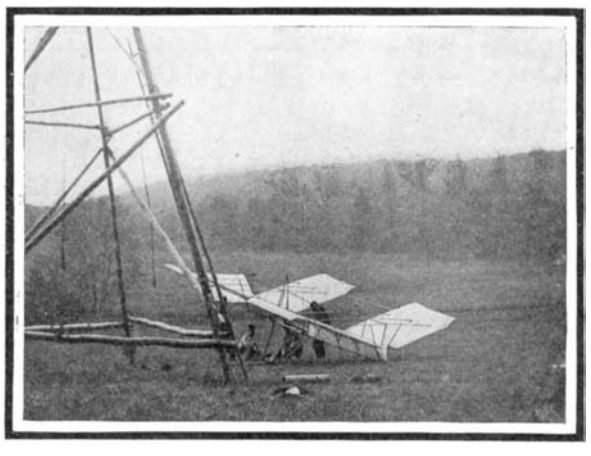
The electric waves measured by Hertz—and named after him—were found by the great scientist to be 150 feet from the top of one wave to the top of the next. The waves used by Marconi in telegraphing across the Atlantic are much longer; in fact, they are 600 feet or more. They travel at the same speed as light—the incredible and almost inconceivable rate of 184,000 miles per second. But the light wave measures only a few millionths of an inch.

THE FRENCH AERODROME CONTEST.

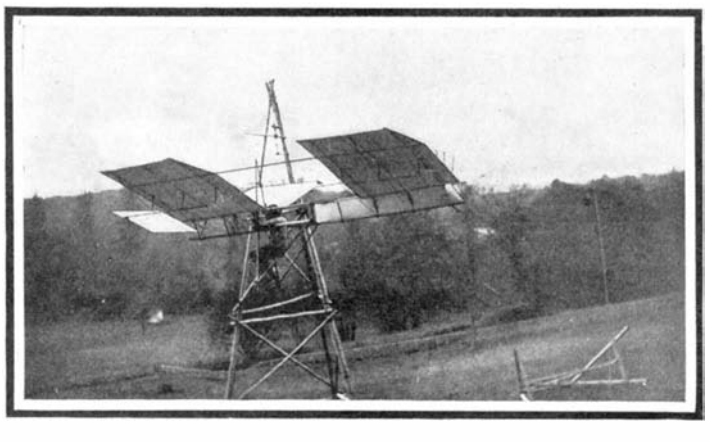
BY OUR PARIS CORRESPONDENT.

The Concourse of Aviation, which was held in Paris on the 11th of February and the two following days, proved to be an event of considerable interest. It was held in the immense Galerie des Machines, the Machinery Hall building left over from the Exposition. It contained sufficient space for this kind of trials, seeing that the apparatus which were entered were mostly in the shape of small models, and the present concourse is intended to be a preliminary one in order to bring the different inventions before the public, and will be followed by a series of tests on a large scale in the open air. The concourse was held under the supervision of the Aero Club of France, and it is intended as one step in the movement which is now on foot to promote the question of aeroplanes and flying machines in general which are heavier than air, as opposed to the dirigible balloon. M. Ernest Archdeacon, whose aeroplane we intend to illustrate, is one of the leading spirits in this movement. The present concourse attracted a considerable number of persons and was quite a success, especially for a first attempt. In the gallery at one end of the hall was erected a high scaffolding of 125 feet, from which the aeroplanes took their flight. On either side were exposed the apparatus which took part in this concourse. Most of these were models which varied from two to ten feet in length. None of them were intended to be mounted by an aeronaut, but were constructed so as to fly in a straight line as nearly as possible, and to keep their balance in the air. Some of them had small propellers which were worked by a spring or by clockwork. One form had a small gasoline motor. Aeroplanes of a single surface or divided surfaces were to be seen. Several forms of kites were also exhibited.

Some of the aeroplanes succeeded in making a good sail, and landed in a more or less straight line at a considerable distance. This is a very good performance when it is considered that they are not controlled by the aeronaut during their flight and the least fault in balancing or the smallest current of air is sufficient to make them deviate. Others kept up their equilibrium in the air, but sailed in a spiral path. Some of them turned several times in a spiral before reaching the ground. It would be premature to base any very definite conclusions from this first series of trials, which is rather of a nature to awaken general interest in the question and to prepare for the open-air con-



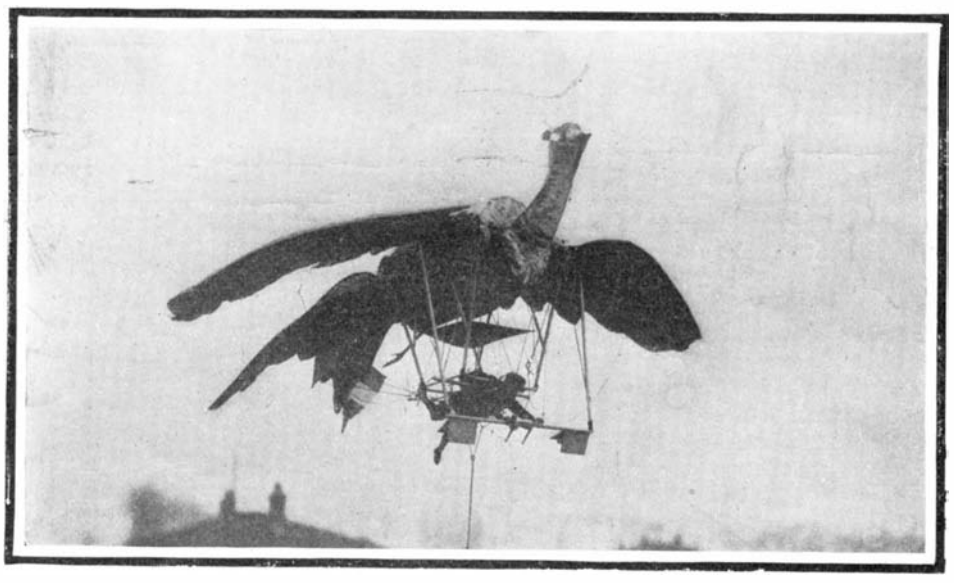
At the Foot of the Launching Tower.



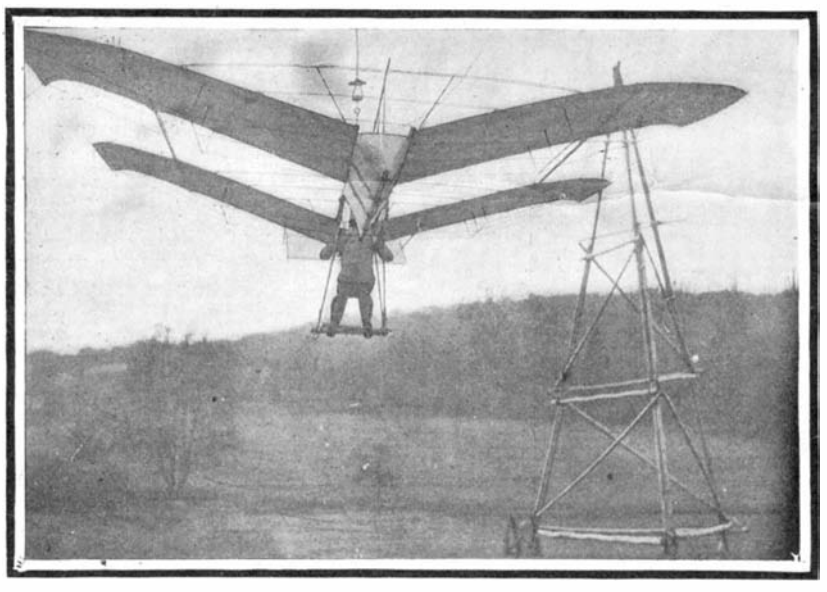
Launching the Paulhan-Peyret Aeroplane.

course of larger apparatus. The Paulhan-Peyret aeroplane, which is here illustrated, attracted considerable attention. It is one which has already made a series of tests on a large scale in the open air, in Capt. Ferber's aerodrome. It is built on the Langley system as to general principles, having two sets of double surfaces or wings separated by an intervening space. The inventors add a smaller plane in front to assist in lifting the apparatus. Contrary to the opinion of many persons, they consider the two surfaces as having an equal sustaining force, and in consequence they distribute the load equally, placing it between the sets of planes. Up to the present, their experiments have borne out this idea. This aeroplane was tried during last October, mounted by one of the aeronauts. Its total length, front rudder included, is 20 feet. The trellis-work support is 16 feet long. The total width of the aeroplane is 16 feet. The wings are each 6 feet wide, and the total surface of the aeroplane is 25 square yards. The front rudder has a surface of two square yards. As to the weight, the apparatus alone weighs 90 pounds, or 240 pounds with the aeronaut. This figures about 10 pounds per square yard of surface. In the flight, the results were as follows: For a difference of level of 5 feet, a flight of 40 feet; for 6 feet, a flight of 50 feet.

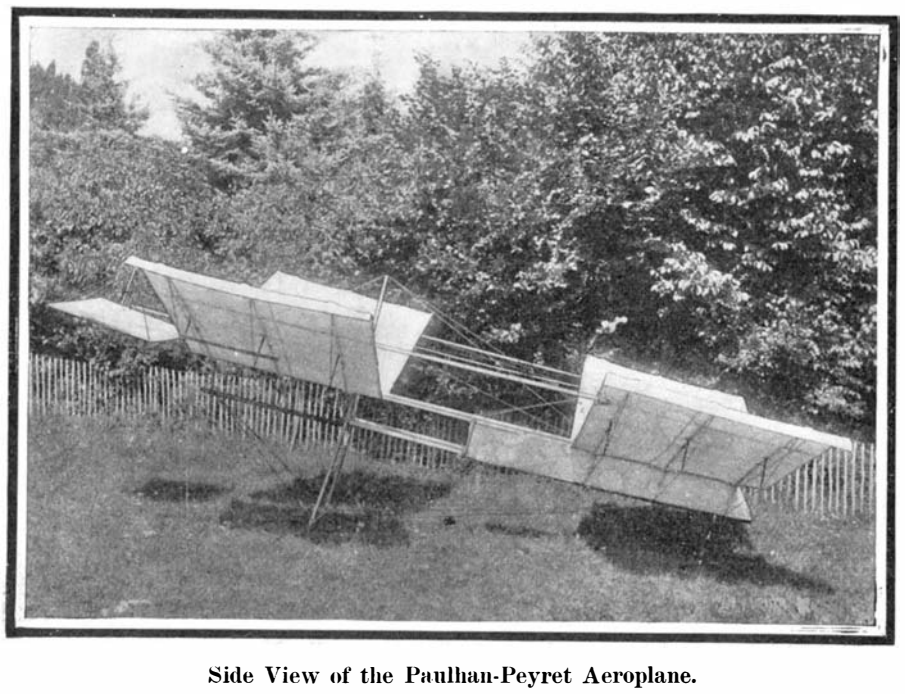
The Brazilian government has embarked upon an extensive naval building scheme comprising twenty-nine vessels. The programme is composed of three battleships, each of 13,000 tons displacement; three armored cruisers, each of a displacement of 9,500 tons; six torpedo-boat destroyers; twelve torpedo boats; three submarines; a transport of 6,000 tons; and one training ship of 3,000 tons. The battleships are to be of similar design to the two battleships built in England for the Chilian navy and subsequently acquired by the British Admiralty. They will have a speed of 19 knots, while the cruisers will be of 21 knots speed, and the destroyers 30 knots. The submarines will be approximately of the same design as those now being constructed for the British navy by Vickers, Sons & Maxim, of Barrow-in-Furness. The work of construction is to be spread over a period of about ten years, and all the vessels are to be constructed in Great Britain, probably by Vickers, Sons & Maxim and Sir W. G. Armstrong, Whitworth & Co., Ltd., of Newcastle-on-Tyne, respectively. The Brazilian government has already stipulated that Vickers-Maxim improved armor is to be adopted on the vessels.



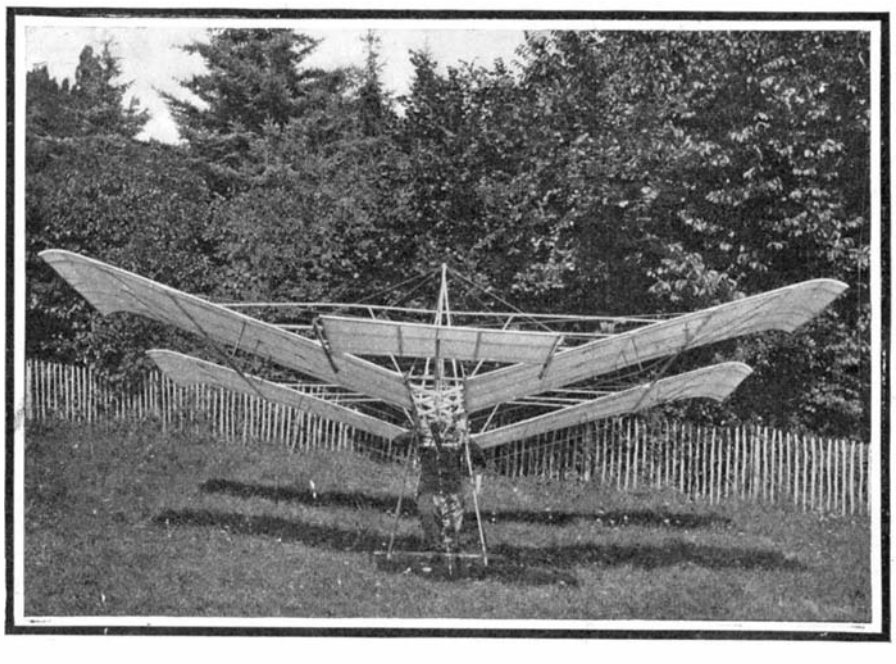
Gellet's Mechanical Bird.



The Paulhan-Peyret Aeroplane under Way.



Side View of the Paulhan-Peyret Aeroplane.



Front View of Paulhan-Peyret Aeroplane.

SCENES FROM THE FRENCH AEROPLANE CONTEST.

INOCULATING ANIMALS AGAINST DISEASE.

Of recent years practical attempts have been made to use the antitoxin treatment for the prevention of disease in animals of the lower orders, and many domestic pets have been inoculated in order to ward off the various complaints to which they are peculiarly subject. The laboratories making a business of preparing such serums are now putting up animal antitoxins as a regular thing, and are said to experience no difficulty in disposing of them.

The originators of the idea reasoned, and apparently correctly, that if antitoxins were beneficial to the man, they must be to the dog and cat. The only difference would be in the material of the serum. Mr. George Cugley, who has made animals his life study, began two years or so ago to experiment with antitoxins intended for the lower animals, and he now claims that complete success has attended his efforts.

The method is simply to inject the serum hypodermically into the blood of the animal by means of a needle-pointed syringe. The "vaccination" in the case of a dog or cat does not "take" as it does with human beings. There is no eruption. The serum is injected into the blood, and according to the advocates of this method of treatment, renders the animal immune from the attack of the disease it is intended to fend off.

The greatest demand is said to be for distemper antitoxin. Despite the fact that innumerable distemper cures are advertised, the animal experts know that it is scarcely worth while trying to save a dog when once he has contracted this very common complaint. Animal dealers themselves, notwithstanding the long list of "guaranteed cures" for distemper, have about agreed that the most satisfactory method of dealing with a dog who has contracted distemper is to put him out of his misery at once, as the difficulty of curing the animal, combined with the immense trouble involved in treating him and the danger of other dogs contracting the disease, makes it poor economy to attempt to save the animal's life.

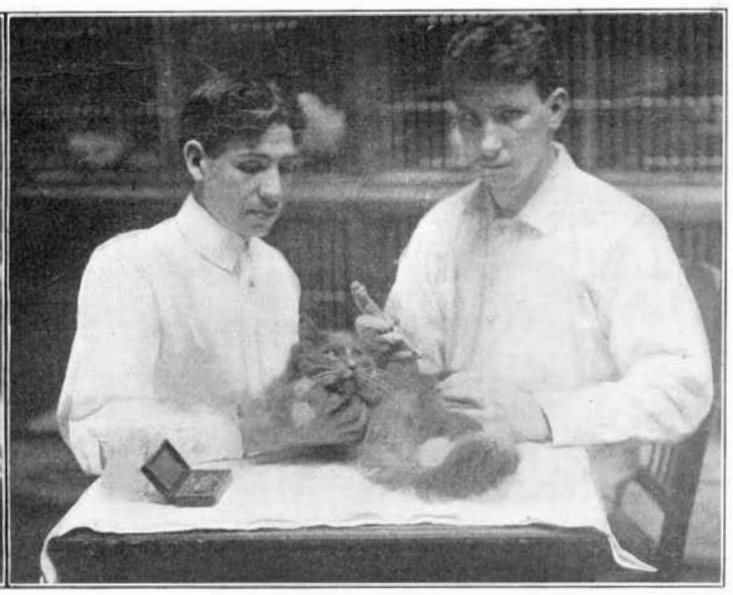
It is another matter, however, to successfully prevent the contracting of the disease, and this, it is claimed, is now possible by means of the inoculation method. Instead of deliberately exposing the puppies to the danger of contracting distemper in order to have it over and done with, no matter whether the dog live or die, the owners will now be able to have the animals hypodermically treated with an antitoxin that, it is claimed, has proved efficacious in many cases. In pursuing the investigations, experiments were made in which healthy animals, some inoculated with the serum and the others without it, were confined with dogs afflicted with the disease. In no case did an inoculated animal contract distemper, while those not treated with the antitoxin did so freely. The complaints to which cats are subject are very much the same as those that attack dogs, and the antitoxin has been adapted for use in the feline family. Monkeys and rabbits are also inoculated as a safeguard against various diseases peculiar to the species. A monkey is a delicate little creature, and is subject to many ills. As they are rather valuable pets, it is therefore very desirable to insure the animal's life as far as it can be done by inoculation.

OLD CLOCK OF THE CITY HALL OF ULM.

More important than the prevention of diseases of the common variety in the domestic animals, is a series of experiments now being conducted to determine whether or not there is any means of eliminating the scourge of rabies from the list of evils to which the canine race is subject. Strangely enough, it is a subject on which there is little reliable information, and around which controversy rages. Some medical men declare that there is no such thing as hydrophobia in the human family, and others contend that frequent cases of the disease in human beings result from mad-dog bites. Regardless of these theories, the prevalence of rabies among dogs is recognized, and earnest work is being done on the problem of procuring a serum that will kill the disease in the canine family. Beginning with the theory that dogs are no more subject to attacks of rabies in what are known as the "dog days" than at any other time of the year, the investigator argues that the disease does not originate spontaneously, but is communicated only by contagion, extremes of temperature having little to do with its propagation.

In Russia, where the disease is quite prevalent, being spread chiefly by the wolves, it rages most violently after an excessively hard winter. This is thought to be due to the fact that hunger encourages the wolves on such occasions to roam more freely than usual in the inhabited regions in search of food, thus distributing the contagion. Statistics that have been compiled show that apparently just as many persons are bitten by dogs supposedly mad, during the months of April and May, as in the hot months. If this belief that the question is one of contagion is correct, there may be grounds for thinking it possible to find an antitoxin that will kill the germ, and destroy this phantom that causes disquietude in every household in which there is a pet animal. And as animals have been inoculated with a serum making them immune against one complaint, it appears to be only a step to the discovery of an antitoxin that will make hydrophobia a dread of the past in dogdom.

Giving a Dog an Injection.



Inoculating a Pet Maltese Cat.

Fortifying a Rabbit Against Disease.

Antitoxin for a Monkey.

INOCULATING ANIMALS AGAINST DISEASE.

THE ASTRONOMICAL CLOCK OF THE CITY HALL OF ULM.

BY CHARLES A. BRASSLER.

Visitors to Ulm, a city of the olden time, cannot but be struck with its quaint architecture, its crooked streets, and the "go-as-you-please" manner of its busy inhabitants. Almost unconsciously they drift to the business center of the town, where they find the ancient Rathaus situated on one side of a spacious square, raising aloft its high peaked roof and towers. The astronomical clock installed in the eastern end of the old hall is a noteworthy production of the clockmaker's art, and dates from the beginning of the sixteenth century, it having, according to information there obtained, been thoroughly repaired in 1549. At that time there could be found in Ulm no horologist or clock-maker competent to undertake the reconstruction of the complicated mechanism. Application to the adjacent towns of Tübingen and Kirchheim were likewise without result. Finally the common council, in 1580, commissioned the most famous German clock-maker of the day, Isak Habrecht, of Strasburg, the builder of the famous clock in the cathedral of that city, to effect the necessary repairs, which he did to the perfect satisfaction of all concerned. On the 12th of April, 1581, so the story goes, he was paid 200 thalers and allowed to leave the city. From an artistic point of view this clock is a masterpiece; it shows not only the passing hours of the day but also the diur-

nal and annual revolutions of the earth as well as the movements and phases of the moon.

The zodiacal circle is highly artistic. Made of beaten copper, the twelve signs are executed in fine style and move upon a star-spangled blue ground which represents the firmament.

The dial plate is essentially of copper, the indices, as well as the hands, are of pure copper enhanced by a washing of gold.

In the outer circle we find the quaint old Roman numerals from I to XII. Equally spaced between them are rosettes which serve for the half-hours. Behind this is the blue background with its galaxy of sparkling stars over which, as indicated above, move the signs of the zodiac.

Just within this is a smaller circle containing the 24 hours of day so arranged that the number 12, indicating the hour of noon, falls under the Roman XII at the top of the dial and the 12 of the midnight hour is just above the VI at the bottom of the dial. To the right and the left and half way between these two, are placed the figures 6, which respectively represent the morning and the evening hour. The innermost field of the dial is divided into two sections, one of which is painted white, the other black. The white represents the horizon. Mounted upon this inner field are two gilded rings of which one represents the Tropic of Cancer, and the other the equator, while the raised ring, also gilded, between the white field and the 24-hour circuit, represents the Tropic of Capricorn. Beginning from the bottom the first movable object we have on the dial is the circle containing the signs of the zodiac. This ring is supported upon two crossed iron rods, and they are so arranged that one of them passes through the vernal point on one side while its opposite end runs through the autumnal point on the other. Of the other rod the two ends pass respectively through the summer and winter solstices. The signs are arranged in a consecutive order contrary to the motion of the hand of the clock; thus we have first Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces. The outside edge of the zodiacal circle is supplied with a graduated scale of 360 deg., which is intended for the Dragon hand. Supported also upon the crossed rods that carry the zodiac is an eccentric circular band called the calender disk, because upon it the days and the months are engraved, and these are so ordered that the rods pass through the dates of March 21, the first day of spring; September 23, the beginning of autumn; June 21, the commencement of summer, and December 23, the first day of winter. Next above the zodiac is the dragon belching forth flames of fire, its head reaching over the zodiac as far as the graduated scale, while the writhing tail extends backward among the signs. This dragon hand is intended to represent the path of the moon. Directly above this hand is placed the sun indicator. It consists of a plain iron rod supporting at one end the radiant face of the sun made of embossed copper and handsomely gilded. This face reaches to the lower rim of the zodiac. Next above the sun hand is that of the moon, likewise a thin iron rod, bearing upon its end a hollow hemisphere of which the rounded half is gilded while the plane surface is painted black. This supporting rod is hollow, and through it runs a movable rod to which the moon is attached, and upon which it revolves, thus showing its phases. The miter wheels at the center of the clock, that produce this motion of the moon, are attached to the sun hand. The moon is also arranged so that it too appears to pass through the signs of the zodiac. Revolving above the moon arm is the regular hour hand of the clock, and this takes the form of a human hand with extended index finger, placed also upon the extremity of a simple iron rod. This finger just reaches to the feet of the Roman numerals. When looking at the dial, to experience its full effect, the observer must imagine himself as standing upon the earth at the center of the dial. Then the whole system, except the hour hand, will make one complete circuit in 24 hours. The zodiac revolves once in a sidereal day, which is 23 hours and 56 minutes, while the sun requires 24 full hours to get around. He thus loses 4 minutes every day, and being retarded by that much passes consecutively through each zodiacal sign until at the end of 365¼ days he will have completed the circuit and reached again his original starting point. In its procession through the zodiac the sun hand moves over the calendar ring and indicates the date; when the sun hand is tangent to the calendar ring in the white field it shows the time of sunrise; when the same tangentiality takes place in the black field it shows the time of sunset. The sun hand then indicates first the annual motion of the sun in the zodiac, the twenty-four hours of the day, the date, and sunrise and sunset for every day in the year.

The moon falls so far behind the sun hand in its procession through the zodiac that in 27½ days, an ordinary month, it is again at its starting point, and in 29½ days it is again in conjunction with the sun or has completed a synodic month. During this turn around the face of the clock it makes one complete revolution upon its own axis, thus displaying its phases to the observer. When it is directly over the sun it presents its black or dark side to the observer, and it is then new moon; after about 7⅜ days it is at right angles to the sun, then half the gilded and half the black side are visible—in other words, it is in its first quarter; 7⅜ days later it will be directly opposite the sun and the whole of its gilded side will be presented to view; it is now of course full moon. Since the orbit of the moon is inclined to the orbit of the earth, otherwise called the ecliptic, by an angle of about 5.9 deg., the moon's orbit cuts the ecliptic at two points. Consequently the moon in its passage will be half the time above the ecliptic and during the other half fall below it. The first point is termed the ascending node, and the other the descending node. The revolution of the moon through its nodes is called the dragon month, and this is shown, as we indicated above, by the dragon hand. These nodes are also known as the dragon's head and the dragon's tail. The line connecting these two nodes is called the line of the moon's nodes, and this is what the dragon shows upon the dial. When the moon passes over the dragon's head it is just then going through the ascending node; when, on the contrary, it crosses the dragon's tail it is going below the ecliptic or is at its descending node.

The line of the moon's nodes changes its position in the ecliptic very quickly; it turns in a direction contrary to the succession of the zodiacal signs, wherefore the dragon hand hurries on in advance of the zodiac, contrary also to the direction of the sun, and consumes 18½ years for a complete circuit through the zodiac. An eclipse of either the sun or the moon can only take place when the moon is either at new or full moon and is passing through one of its nodes. For this reason in an eclipse of the sun, which can only take place at new moon, the moon being at the same time at its node, the sun hand, the moon hand, and the dragon will be directly over each other whether at the ascending or descending node. An eclipse of the moon, on the contrary, can only take place at full moon, the satellite being, of course, at the moment, at one of its nodes. This case will be indicated by the clock by bringing the sun over the head of the dragon while the moon will be over its tail, or, *vice versa*, the sun over the dragon's tail with moon over its head. In this wise, then, the dragon shows the motion of the moon through its nodes, the procession of these nodes in the ecliptic, as well as the lunar and solar eclipses.

The calculation of the clockwork is so worked out that a new adjustment of the hands need only take place after the lapse of 100 years.

The Julian year of 365¼ days was selected, and this will differ from the Gregorian century by just one day in 100 years.

At present the astronomical part of this wonderful clock is temporarily inoperative. This portion of the works has been sent to a manufacturer of turret clocks in the city of Ulm to be set in order and refurbished, and it is hoped that the clock will soon again indicate all that we have described above with the minute exactness with which it has been credited in former years.

Upon a stone balcony just under the clock panel, the ceremony of offering allegiance to each new Kaiser has been performed, by the city fathers and the citizens ever since 1473. On either side of the clock were painted heralds or kings at arms bearing aloft the standards of the empire and of the city of Ulm, and in the gable just below the present small clock face was a procession of the three Magi of the East in their adoration of the Holy Child. Above this was a sun-dial, and topping all peered through an opening in the wall a figure of a human face which was doubtless connected with the clockwork and moved from side to side to tell the time on the sun-dial. Upon the ridge of the gable is a small belfry of which the roof was at one time gilded. In this little house was hung the poor sinner's bell. The bell tower proper is a slim ridge-turret that sits upon the ridge of the highest roof finished with glazed tiles.

The Current Supplement.

An illustrated article on the Japanese hydro-electric power plant at Kyoto opens the current SUPPLEMENT, No. 1524. The carbureting of heavy oils is a subject well discussed by R. Desmarest. Prof. Dewar's discoveries of new uses for liquid air will be read with interest by students in physics. The Warren rotary engine, which has been successfully used in actual practice, is described and illustrated. Dr. F. M. Perkin gives some valuable hints on electrotyping. How a simple, effective, and inexpensive lightning recorder may be constructed is told by Henry G. Alciatore. Prof. Vivian B. Lewes, whose work in the chemistry of gases is known to every scientist, writes on the theory of the incandescent mantle with the forcefulness and originality characteristic of all his work. The last installment of an article on Lhasa and Central Tibet is presented. Many illustrations of Tibetan scenes also appear. A most entertaining article is that bearing the title "The Good Old Times," which shows that whatever our fathers may think of the degenerate conditions in which we now live, we have reason to be thankful that we belong to the twentieth century. Mechanically considered, the most valuable article is one by Thornton Knowles on Epicyclic Trains. Diagrams are, of course, presented to illustrate the text. An article on "Elements Verified and Unified" presents an account of modern physical conception.

A STUDY OF THE BROOKLYN BRIDGE PROBLEM.

BY EDWARD WHITEHEAD CURTISS, M.E.

The city bridge department, knowing the bridge is loaded to near the maximum load it was designed to carry, as a cautionary measure, to prevent overloading, has made rules as to loading. At least 102 feet of empty track space must exist between every two trolley cars on the bridge, and but one elevated train on each track is permitted upon the center span at the same time. These rules are necessary, as the load on the bridge during periods of heaviest traffic is within 125 tons of the maximum load the bridge was intended to carry. A single elevated train or a few street cars would exceed this margin of weight, and if through carelessness they should move onto the span before the train ahead has left the span, the bridge would be overloaded. If it were thus overloaded, it would not, however, be in danger of failure, because it was built with a large factor of safety. But that was twenty-two years ago. What is its factor of safety now? The bridge department should be the best authority. During several administrations it has enforced precautionary rules. The chief engineer stated before the State Railroad Commission: "The Brooklyn Bridge is an antiquated structure, unfitted for the demands made upon it, and should be rebuilt after the completion of the Manhattan Bridge within the next five years." The problem involves a combination of difficulties. The solution is to transport the people over the bridge as fast as they arrive. The factors in the problem are: 1. Safety of passengers. 2. Weight of load on the bridge. 3. Number of persons to be transported. 4. Number of cars required. 5. Speed of cars necessary. 6. Time required for loading and unloading cars. 7. How to make the change without interrupting transportation. 8. Cost of the new system. 9. Time required to put a new system in operation. 10. A proper terminal station. Lack of cars moving over the bridge, and not lack of loading facilities, is the cause of the congestion. More cars and lighter cars is the only remedy. This forces us to a plan for special bridge cars without heavy machinery.

The system of transportation illustrated on the front page of this issue is designed to meet all the above-named conditions. An endless train of cars is operated across the bridge with a circular loop at each terminus, cable traction is used, and the motors, brakes, third-rails, trolley-wire supporters, wires, etc., are dispensed with. Light trucks with small wheels are substituted for the heavy ones now used, and more than double the number of cars can be operated, without increasing the weight; and by operating them on one set of tracks we have an endless train of cars, and may increase the speed with no danger of collision. But this requires that the train shall not stop, and we are forced to use a slowly-rotating loading-platform with access to it by stairways located at the center, where motion is slow. Two cables would be used, driven by electric motors, the motors and cable in duplicate to be used on alternate days. This would reduce the danger of a "tie-up" to a minimum. The electric current could be independently generated, or purchased from power companies. This plan includes no untried feature, unless it be in the combination. Moving sidewalks were tested at the Chicago and Paris expositions, with difference in speed between adjoining platforms of three miles an hour. These cars are inclosed, and the difference in rotary speed of stairways is reduced to one-half mile an hour. Such a plan as this would accommodate all the present passenger traffic on the tracks used by the elevated trains, and the space now used by trolley cars could be used for vehicle traffic, and the capacity of the bridge would be doubled. As the number of cars would be more than double that now used, more than twice the number of persons could be transported without increasing the load on the bridge. A speed of ten miles an hour would do this, but the speed could be changed to meet the changing demands for transportation. All the time now wasted by stopping, starting, backing, switching, and waiting trains would be devoted to moving the people over the bridge, and the motive power required to do it would be less.

At each terminal station there is a circular platform, 200 feet to 400 feet in diameter. The platforms are kept in constant rotation. They ride on wheels, which roll on tracks laid in concentric circles, and the whole is carried on an elevated structure. Stairways at the center of the platforms give adequate and convenient means of access to the rotating platform from the street below and from passageways above from and

to the elevated stations). These stairways also serve as exits for arriving passengers. The loops in the endless train of cars are arranged so as to encircle about three-fourths of the platforms, the cars locking with the platform edge, and rotating the platforms at the same speed as the moving train. People will then be able to step from one to the other with as much ease and safety as they now step from the parlor-car to the dining-car of a moving express train. The stairways, which are attached to the platforms near the center and extend downward to near the ground, rotate with the platforms, but the motion is so slight as to be scarcely noticeable. If the platforms are made 400 feet in diameter, at twenty-miles-an-hour speed of the cars, the stairways would have a rotary speed of one mile an hour. Beneath each stairway, and leading to it, would be an intermediate circular platform, twenty feet in diameter, on a level with the ground. It would rotate in the same direction, with a speed one-half that of the stairways, or one-half mile an hour. An automatic fence prevents a person falling off the platform.

Each platform would have four stairways, twenty feet in breadth, which would accommodate more than 100,000 persons an hour. Congestion on the platforms would be impossible, for if persons packed the stairways as closely as they could, each occupying two feet of breadth, forty persons would fill the eighty feet of stairways; but when they arrived at the edge of platform, beside the cars, they would be more than thirty-one feet apart, the edge being 1,250 feet long, and 940 feet of cars being always in contact with the platform. If a person failed to step off the car, moving at ten miles an hour, he would be carried over the bridge again, and back, and would lose twelve minutes; but if he did not step on the car during the first revolution of platform, he would lose but fourteen seconds, when he would begin his second revolution. He would have sixty-four seconds to step on or off the car as against twenty-eight at present. The proposed plan would reduce the load on the bridge and distribute the load more uniformly.

Results Compared.	Present System.	Proposed System.
Load on span (cars and passengers)	868 tons	716 tons.
Length of loading platforms	440 feet	940 feet.
Number of cars at platforms	10 cars	24 cars.
Number of cars per hour	440 cars	1320 cars.
Number of persons in each car	150 persons	75 persons.
Speed of cars per hour	10 miles	10 miles.
Time for loading	28 seconds	64 seconds.
Number carried per hour at 10 miles	50,000 persons	100,000 persons.
Number carried per hour at 20 miles	——	200,000 persons.
Railways required	4 tracks	2 tracks.
Speed of cars, 20 miles per hour	(Impossible)	200,000 persons.

Roebling's report says: "I propose a speed of 20 miles an hour, as being perhaps the one most likely preferred. But this may be increased to 30 or 40 miles per hour, with absolute safety." (Page 246, Franklin Institute Journal, 1867.)

To render the above plan most effective, the Manhattan loop should extend over Park Row, where a curvature with radius of 125 feet to 200 feet could be obtained. The Brooklyn loop could be built near Tillary Street, between Fulton and Washington Streets. This would practically connect City Hall with Borough Hall.

Pipe Made of Asbestos and Condensed Milk.

An inventor who lives in Orange, N. J., has invented a new kind of tobacco pipe. The stem and bowl are made of asbestos, either by rolling together asbestos paper or thin strips of asbestos forming a tube of the right thickness and dimensions for the bowl of the pipe, hollow at both ends. One end is filled in by strips of asbestos so cut and fitted as to occupy the opening. The stem is prepared in the same manner and is fitted with a mouthpiece. The strips of asbestos forming these tubes are coated with a paste composed of condensed milk and plaster of Paris. In order to burn out the paste the pipe is baked. The inventor states that any color from light brown to ebony can be obtained by varying the heat.

The Dominion Iron and Steel Company has, it is understood, decided to adopt at its works at Sydney, Nova Scotia, a new and inexpensive process for the manufacture of pig iron, utilizing waste iron ore, which costs from 60 to 75 cents a ton. Iron ore in this condition can be used only when it is solidified. For a great many years chemists endeavored to solve this problem, but it was only a few years ago that W. Owen, consulting engineer and foreign representative of Bruck, Kretschel & Co., steel manufacturers, of Osnabrück, Germany, made the discovery. Since then the process has been adopted by seven German and two or three English steel companies with eminent satisfaction. The waste is first solidified, usually in bricks, and in this condition is placed in blast furnaces, when pig iron is produced. The plant which the Sydney steel company proposes to install will cost about $8,000, and will have a daily output of about 75 tons. It will be the first of the kind erected on the continent, and the company will have the exclusive rights for the Dominion of Canada.—George Hill. Vice-Consul-General, Halifax, Nova Scotia.

Correspondence.

The Unsanitary Cake of Soap.

To the Editor of the SCIENTIFIC AMERICAN:

In the last number of the SCIENTIFIC AMERICAN I noticed an article by Mr. G. F. Shaver concerning disease dissemination through toilet soap, as used in public toilet rooms, etc.

It seems quite incredible that the Americans who are so strict and scrupulous in hygienic matters, should have overlooked such a serious evil, which is so very simple to prevent. It struck me as rather strange, therefore, when I came to this country a year ago, and found to my surprise, that even in the first-class hotels the common cake of soap—going every day through a hundred different hands and so getting thoroughly impregnated with germs—seemed to enjoy its existence.

Is there anything simpler and cleaner than the device now in use in nearly every public toilet room in most of the countries abroad? The cake of soap is a thing of the past, and its place is taken by a handy little soap-powder distributer fixed on the washbowl. This apparatus is generally made out of nickel-plated brass, having a cylindrical form; the standard size is, as far as I can recollect, about 4½ to 5 inches high, its diameter being about 1 to 1½ inches. On the top is a flat knob and in the base a small opening. By pressing the knob, the distributer will deliver through the opening a small quantity of antiseptic soap-powder, which is collected by holding one hand under the apparatus. This distributer is not only used in public toilet rooms, but can be found on the washstands in very many private houses. HUCK GERNSBACK.

New York, March 7, 1905.

Do Animals Think?

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Burroughs, in an interesting way, tells us why he thinks that animals do not think, in the February number of the Harper's. He writes: "We are too apt to speak of the lower animals in terms that we apply to our own kind. We can hardly avoid it, but all modern comparative psychologists account for all their actions without attributing to them any of the higher faculties. A certain situation leads to a certain act, not because the animal thinks about it as we do and is conscious of its purpose, but because certain sense impressions give rise to certain impulses, and these impulses result in the act. There is no mental process, no mental image at all in the matter, any more than there is in a man when he instinctively dodges a blow or responds to a fine day or to the odors of his dinner. Sense impressions do it all. . . . We so habitually impute thought to animals that we come unconsciously to look upon them as possessing this power. We know that under similar conditions we think, and therefore we impute thought to them, but of mental images, concepts, processes like our own, they probably have none. Innate or inherited impulse, which we call instinct or internal stimulus, explains most of the actions of the animals. An internal stimulus is applied, and the reaction is quick. Does not man wink, dodge, and sneeze, laugh and cry, and do many other things without thought or will? To adapt means to an end is an act of intelligence, but that intelligence may be inborn and instinctive, as in the animals, or it may be acquired, and therefore rational, as in man. We know that animals do not think in any proper sense as we do, or have concepts and ideas, because they have no language. Thinking in any proper sense is impossible without language; the language is the concept. Our ideas are as inseparable from the words as form is from substance. We may have impressions, perceptions, emotions, without language, but not ideas.

"Animals know only things through their senses, and this knowledge is restricted to things present in time or space.

"Reflection, or a return upon themselves in thought—of this they are not capable." It is very evident to the merest novice in the study of mental philosophy that Mr. Burroughs is no adept. He makes definitions wholly original. He affirms without supporting evidence. And then, too, he affirms that with regard to animals lower than man that is true of all, including man.

For illustration, he says: "Animals know only things through their senses," when, as a matter of fact, material things—and there can be no immaterial things—can only be known through what are scientifically called the sensory nerves.

He affirms that animals know only things through their senses present in time or space; in other words, that they have no memory—a statement entirely contradicted by multitudinous instances, as cited by eminent psychologists, such, for instance, as Lewes and Romanes.

Again, Mr. Burroughs affirms that thinking in any proper sense is impossible without language. He settles the question between the nominalists and realists with this dictum. I should like, with all due deference and modesty, to show that there are plausible reasons for doubting his *ipse dixit*. As the result of a small study of brain phenomena, we have concluded that all that we denominate thinking is due to the presence of reflected images, retained by the nerves of the brain, of outward objects or forces.

That a word first impinges on the nerves of the brain, making there an ineradicable impression. And a word is either perceived as sounds or figures of letters. The impression remains, and comes before the cognizing *ego* as a congerie of sounds or figures.

Mr. Burroughs says that thinking is impossible without language. By language he evidently means words composed of alphabetical symbols of sound. We think him mistaken. We believe that it is possible for an architect to design a cathedral without recalling the name of a single constituent necessary for its construction. We believe that a geometrician is almost entirely independent of language in its alphabetical sense.

We believe that the deaf and dumb think entirely with the images of sensible phenomena.

Thinking is not necessarily voluntary either, as Mr. Burroughs concludes. If so, the great majority of human beings do no thinking or very little. Even Herbert Spencer's great works were the issues of involuntary action of that brain of his, as he tells us in his autobiography. Most of the greatest works, literary and otherwise, were the product of human brains acting without order from the individual will. As the stomach produces in digestion blood and bile, as the generative organs produce human beings, so experience shows to great men their brains produce poems, books, temples. How could it be otherwise?

If a Shakespeare willed a great play, a Milton a great poem, it was because these came into their perception involuntarily first of all. No man that ever lived has willed into existence that which did not first exist. There is going on in these skulls of ours a vast deal that comes not into our consciousness for the arbitrament of our judgment and the action of our wills.

"To adapt means to an end is an act of intelligence, but that intelligence may be inborn and instructive, as in the animal, or it may be acquired, and therefore rational, as in man." (Burroughs.)

This is a very unphilosophical remark, we must confess.

To adapt means to an end is in man only rational because it is acquired, is certainly a very peculiar statement.

If an animal adapts means to an end, does the fact that this act of intelligence is inborn or acquired make it any the less an act of intelligence? How can we deny reason, which is the comparing of objects and drawing conclusions and forming plans, to the builder of a dam, be he a man or beaver? The adapting of means to ends by the spider, by the bird, by the beaver, the ant, the ostrich, and most other animals of the brute genus displays intelligence, and this is an attribute of mind.

Mr. Burroughs affirms that winking, dodging, sneezing, laughing, crying, are not thinking in men any more than in animals; that they are only the result of sense impressions.

I think it very hard to show that all we think and do, from sneezing to preaching, is not the resultant issue of sense impressions. "Of mental images like our own, animals probably have none." (Burroughs.)

The image of a chair or table must have the same appearance on the sense of a fly as on the sense of a babe in the cradle. Of course knowledge affects the conception formed of a table. A cat sees precisely the same image of a chair that I do, and forms a conception of it which includes its figure with the use which the cat may put it to. Our conceptions of the chair differ, but are they not both conceptions?

Yes; there is not the slightest doubt to be entertained that all our consciousness of thought and all thought, conscious or otherwise, is the result of the brain's activity of all the animal creation, each animal, from ant to man, having the sort of machinery of mind suited to its conditions and needs.

FRANCIS WASHBURN.

Newburg, N. Y., February 23, 1905.

A new type of stove, the object of which is the abolition of smoke, no matter what fuel is employed, has been demonstrated in London. The invention comprises a screen of tubular fire bricks, made of special material built up in the furnace in such a position that all the products of the fire pass through the screen. The latter quickly becomes incandescent, and flashes the gases as they pass through, thus preventing the formation of carbon. By the aid of this device, coal of the worst description can be burnt in the ordinary boiler with practically no smoke, and with a considerable saving in cost. For the purposes of demonstration, cheap damp coal dust was burned. The only result was a light gray cloud at the top of the chimney stack, which cleared away in a few seconds.

TRANSPORTATION OF MATERIALS BY ELECTRICITY.

BY A. FREDERICK COLLINS.

The displacement of trucking with teams over long, circuitous routes by automatic electric equipments is one of the methods where the manufacturer is enabled to effect large savings, for with a modern telpherage system one man now does alone what many men and horses have hitherto accomplished.

The earlier telpherage systems comprised a number of buckets or carriers suspended from electric cables, and these were conveyed from one point to another by means of electric motors that received the energy to operate them directly from the supporting conductors. Usually two lines were provided, an up line and a down line, but they were self-acting only to the extent of traversing the circuit.

These systems were usually designed for the carrying of ashes, coal, and earth; but, crude as these devices were, it was evident that with improvements they could be made a hundredfold more useful and that by additional appliances to lift and lower the carriages they could be adapted to the transportation of all kinds of raw and finished materials.

In a recent equipment installed at the works of the Baker Chocolate Company at Milton, Mass., the modern telpherage system has taken on the form of a miniature elevated electric railway, and now, instead of a suspended cable carrying buckets, we find a structure substantially built, and on this overhanging telpher trains are run.

The purpose of this extensive yet simply operated telpherage plant is to convey the cocoa beans and all other material used in the output of the company from the railroad storehouse to the new mill. Formerly all this raw stock was carted by a number of teams around the works by a tortuous route for a long distance, necessitated by the nature of the country; it then had to be transferred manually to elevators, whence it was carried to the third floor of the mill.

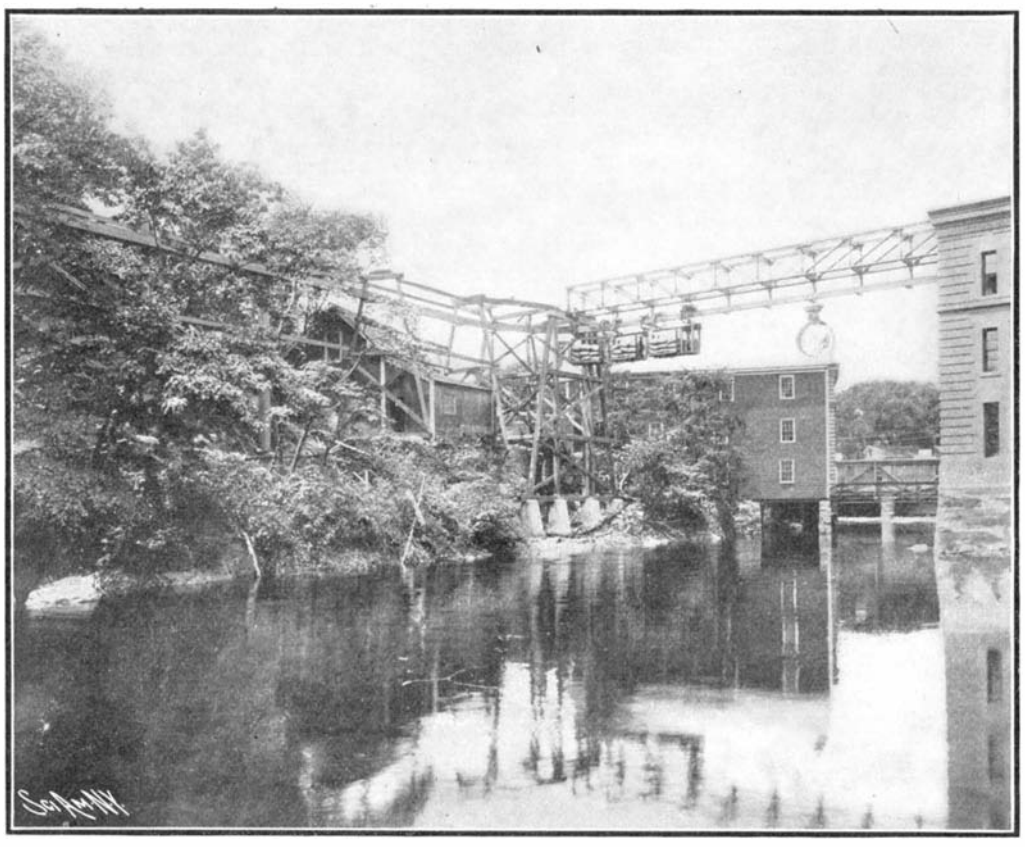
This primitive process not only required time and labor, but, what is more to the point, as seen with a manufacturer's eye, it was exceedingly expensive. Hence the telpherage system under consideration was designed and installed to take the load directly from the top floor of the railroad storehouse and convey it by the shortest possible route to the third floor of the mill, where the manufacture of cocoa and chocolate is commenced, and thus the cost of transportation of the raw stock is reduced to a minimum.

The route presents a most difficult example of telpherage engineering, as the accompanying photographs will indicate. As an instance, one section of the line was built upon the side of a precipitous cliff half-way down, and in some places the track is fifty feet above ground; but finally the road was completed, the distance between the objective points was reduced to the last limits, and as far as time and space entered into the proposition, they were all but annihilated.

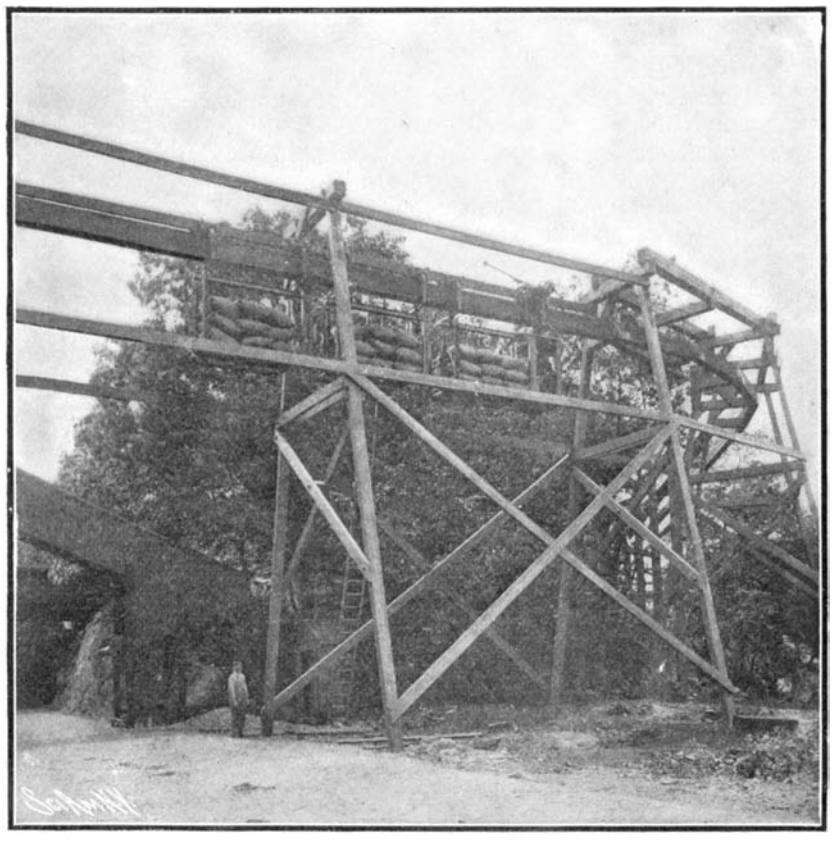
The only piece of level ground that the track follows is for sixty feet beyond the railroad warehouse; it then turns a ninety-degree curve of 40 foot radius and passes along the side of a rocky, precipitous cliff at the base of which is a swift-running river. Another ninety-degree curve of 20 foot radius is then made after passing over the roof of a building, on the rocky ledge of the river bank, and thence the track is carried across the river, on a splendid steel bridge, erected under the most difficult conditions, into the third floor of the new mill.

On the level this portion of the track is supported by A bents 35 feet above the ground, resting on concrete foundations. Along the cliffs the supports consist of huge vertical posts of Georgia pine, 14 inches square, varying in length from 30 to 40 feet. The foundations of these posts are cut out of the slanting side of the solid rock, and they are braced by heavy timbers in the shape of a figure 4, these also being anchored back in the solid rock. When one considers the extreme length and weight of these poles, each of which weighs over a ton and a half, the difficulty of carrying them along the side of the precipice and standing them up on end will be in a measure appreciated.

Another feature was the spanning of a building and elevating the track nearly 15 feet over its roof without molesting the building in any way. On the slanting rock of the river bank the foundation piers which support one end of the steel bridge were built up, using many tons of concrete. The top of this tower is 55 feet above the water, and the distance between the

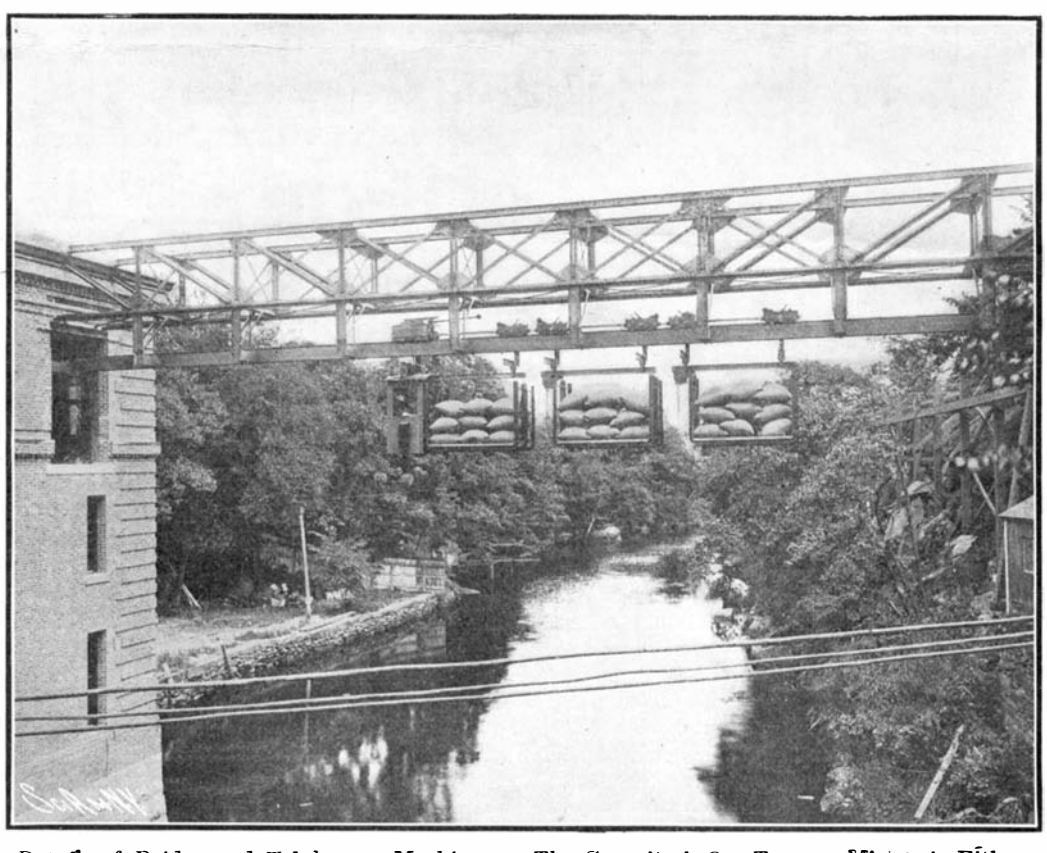


The Concrete Foundations for the Supports of the Steel Bridge Which Spans the River. Telpher with Full Load about to Pass around the Curve.

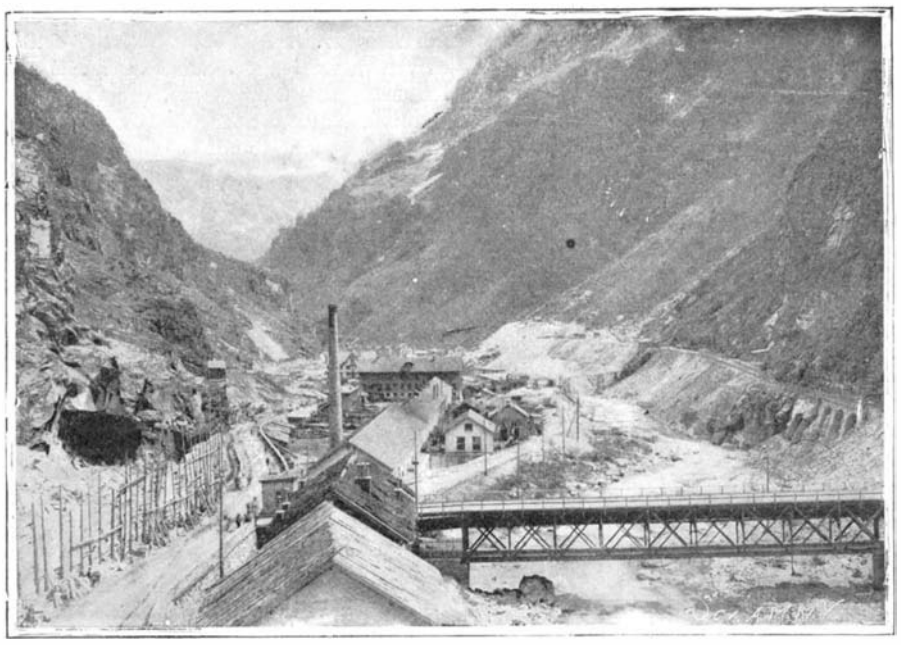


From the Storehouse, the Telpher Train Crosses the Road, Rounds the Curve, Travels along the Bank of the River, then Crosses the River upon a Steel Bridge and Enters the Mill.

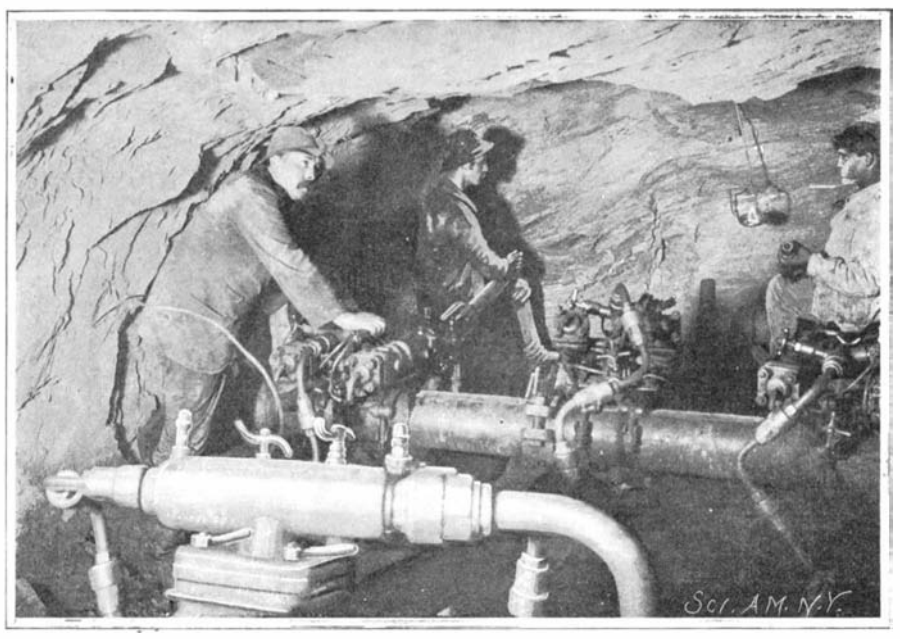
The Line was Built on the Side of a Cliff, in Some Places 50 Feet Above the Ground. The Upright Posts are Supported in Concrete Footings.



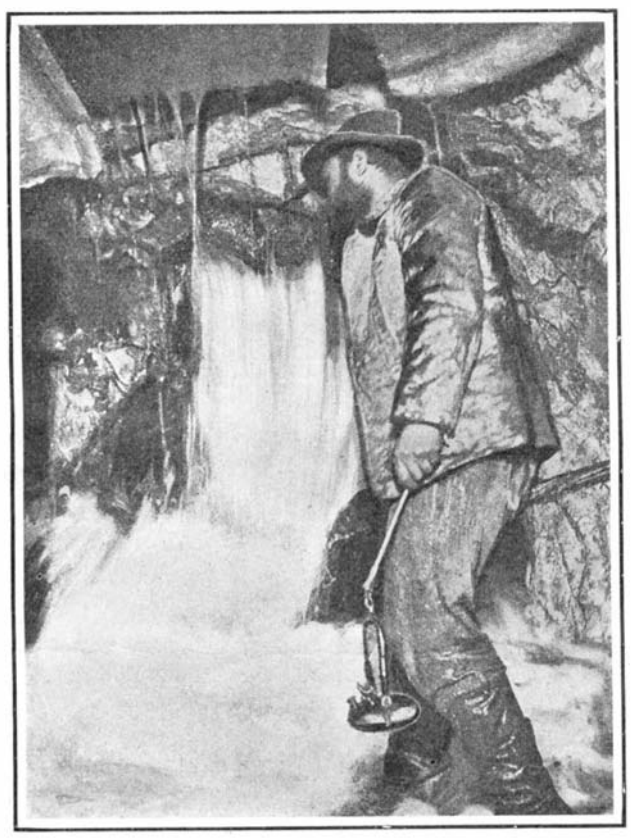
Details of Bridge and Telpherage Machinery. The Capacity is One Ton per Minute in Either Direction or Two Tons per Minute if the Loads are Carried in Both Directions.



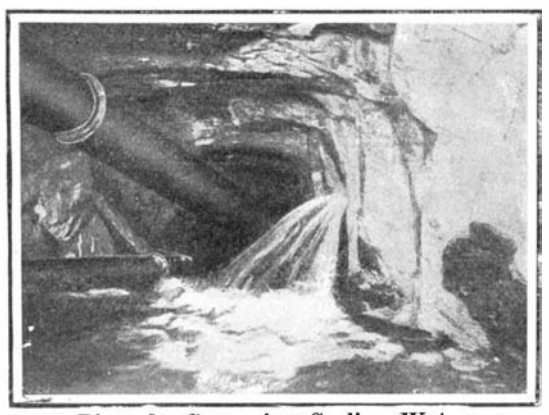
Upper Power House. Iron Bridge Across the Diveria for the Flume. To the Left, a Small Tunnel Leading to the Main Tunnel.



Three Brandt Hydraulic Rock Drills, with Which all the Rock-Drilling Was Done.

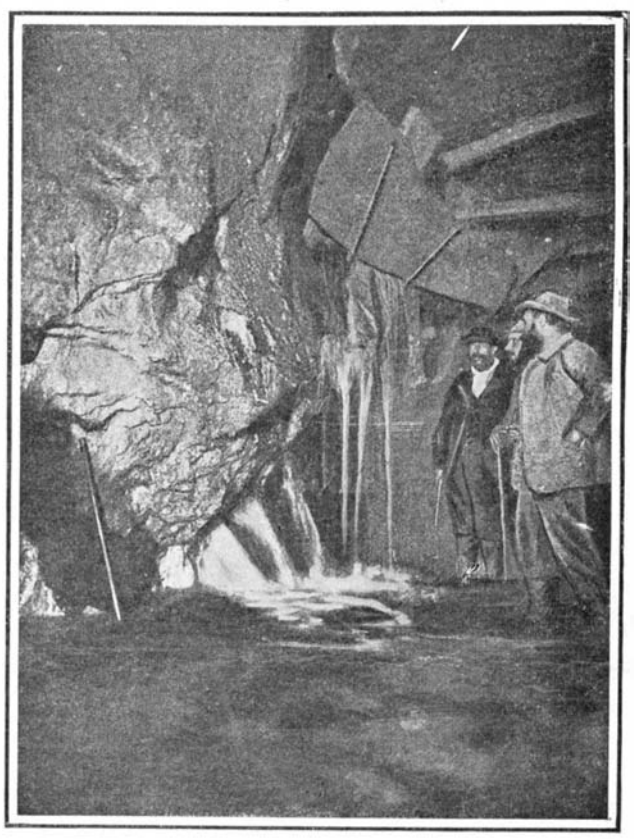


A Large Spring of Hot Water in Side Wall.



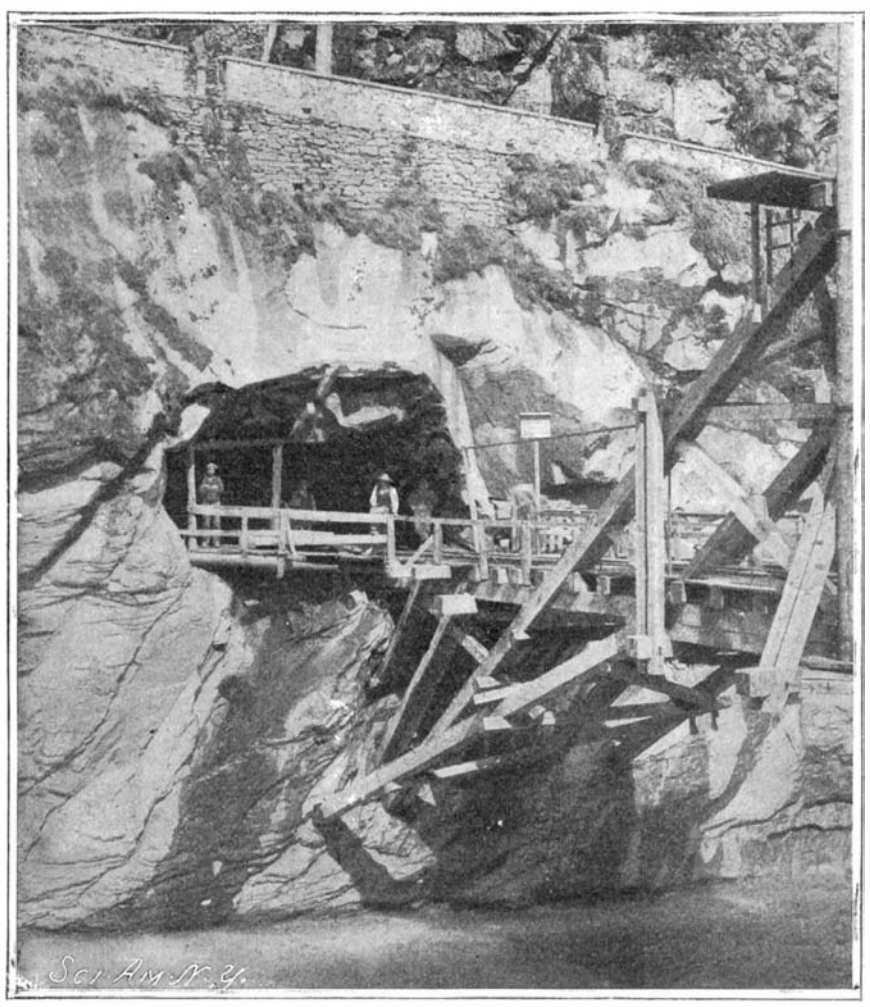
Pipes for Conveying Cooling Water.

Springs Gushing from Tunnel Walls.

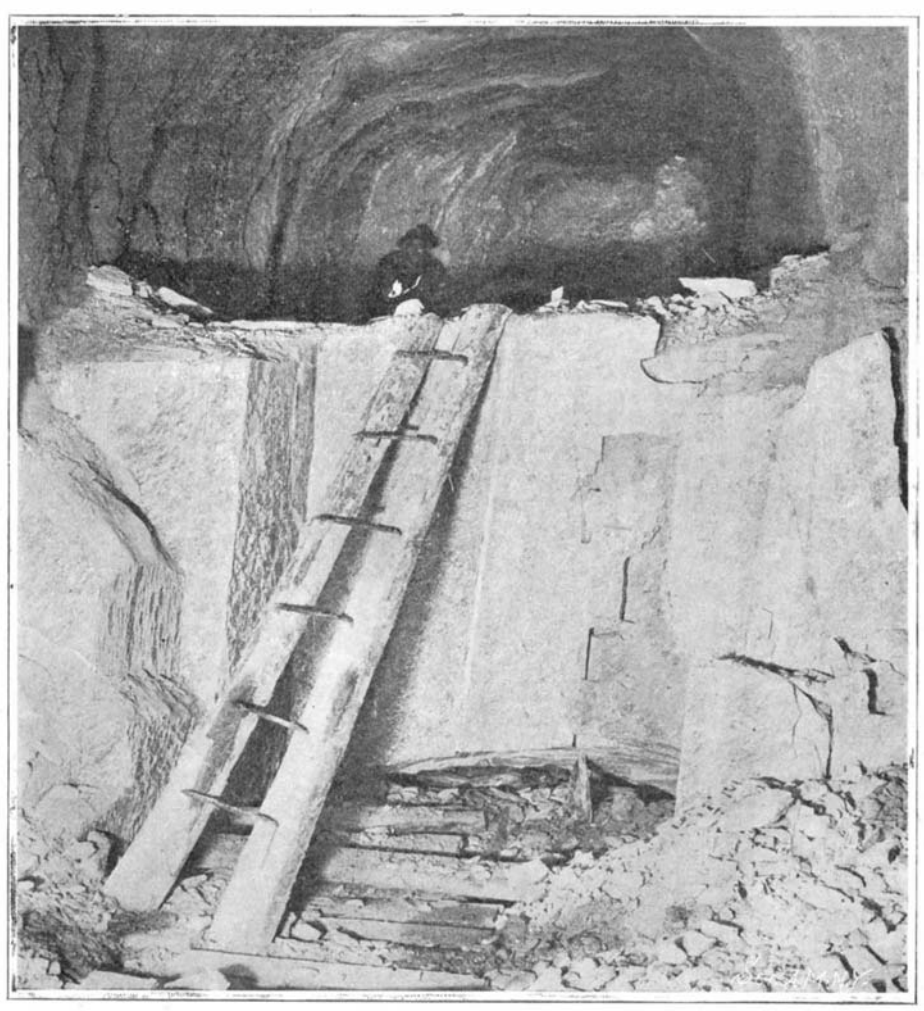


A Spring in Roof Partially Stopped by Boards.

Difficulties from Flooding Met With in Boring the Simplon Tunnel.



Entrance to a Gallery on the South Side, Showing Bridge Across the Diveria.



Cut in the First Tunnel, 4,500 Yards from the Entrance.

THE COMPLETION OF THE SIMPLON TUNNEL.

tower and the wall of the mill, which rises directly up from the water, is 80 feet. This distance is spanned by a heavy steel bridge carrying the track beneath it. The elevation of the track effectually prevents it from being blocked by snow in winter, a serious impediment always to teams or any surface transportation.

The bags of cocoa, each weighing about 300 pounds, are loaded on trucks in the railroad storehouse; each truck has a capacity of 2,000 pounds, and when these are loaded they are pushed underneath the rail and hooks are attached. The operator raises the trucks several inches clear of the floor, then starts the telpher with its load of three trucks of 2,000 pounds each, and in three-quarters of a minute the train has passed by the precipitous cliff, on across the river, and has landed the load of three tons of cocoa beans on the third floor of the mill. The trucks are now unhooked from the machine and pushed out of the way and three empty ones are hooked on in their stead in less than one minute's time and the operator is on his way back to the storehouse, where three more loaded trucks are awaiting him; in this way no time is lost and the entire trip has not taken three minutes.

The telpher, or electric locomotive in this case, runs on top of a single overhead rail and is controlled by an operator seated in an inclosed cab, which is suspended from the telpher directly beneath the truck, the combination really forming a little monorail system. The operator has his controller, which is exactly like an ordinary trolley car controller, at one hand, and at the other hand is a powerful brake-wheel which applies the brakes simultaneously to the telpher as well as to all of the trailers which carry the trucks suspended beneath them, so that the whole train can be stopped within its own length.

The current is supplied to the telpher through trolley wires, being taken off by a trolley pole. The total length of the train is 30 feet and the average speed is at the rate of about 700 feet per minute. The weight of the machine is 4,600 pounds, and with the three loaded trucks the total moving load on the structure is 12,000 pounds suspended from the overhead rail.

This is the system that is eliminating the work of man and beast, and which resolves the carrying of materials, however fragile, however costly, over long and tedious routes, and one telpherman at two dollars per day does the work better than five men and twice as many horses in the old way. The cost of the power consumed by the telpher in running back and forth for ten hours does not amount to more than one dollar for the day's work.

Although this is only one of the many plants designed by the Telpherage Company (there are nearly seventy-five in the Eastern States alone), it is typical of the high degree of efficiency that has been reached in this branch of electrically-operated mechanism.

THE COMPLETION OF THE SIMPLON TUNNEL.

BY CHARLES R. KING.

The boring of the Simplon tunnel has at last been completed, the thin diaphragm of rock that separated the two headings having been finally burst through on February 24, 1905. The success of an enterprise of such magnitude marks this as the greatest event in civil engineering for several years past, during which time the work has been progressing quietly with persevering energy and patience, while the outside world has in the meantime changed with greater ease in its geographical and political bearings, suppressed nations and peoples, and sacrificed millions of lives at the altars of conquest and lawful depredations, as in the remotest ages of barbarism. But the boring of a simple tunnel could not, even with all the wealth of a dozen empires, and all their terrific armaments of blasting machinery, be accomplished faster even to please the rulers of peoples. However, the triumph here is quite different, and will endure hundreds of years, or time sufficient for empires and peoples to change national proprietorship several times over.

It is already known that the Simplon tunnel is 19.729 kilometers, or 12¼ miles, in length, constructed with twin passages, each 16½ feet wide, and separated by a distance of 55.7 feet between their axes; that the tunnel is straight throughout except for a short curve at each of its ends, in order to join its tracks with the outside railroad lines, which have both to follow along narrow valleys or gorges (the Rhone valley in Switzerland and the Val Vedro in Italy) and with the alinements of which the tunnel forms an obtuse angle. The grade of the tunnel is, as is known, 2 per 1,000 from the Swiss portal and 7 per 1,000 from the Italian portal. The summit of the line, 704.3 meters (2,310 feet) altitude, is reached at 9.572 kilometers (5.944 miles) from Brig and is situated in the subsoil of Italy.

The tunnel will bring not only Geneva and southwestern, or French, Switzerland into closer communication with Milan and the Adriatic railways of Italy, but it will shorten the distance from Calais to Milan 80 and 95 miles respectively over the other routes now passing through the Gotthard and Mont Cenis tunnels.

The new Simplon route will eventually not only be a still shorter way to the Adriatic coast from north Switzerland (Basel) and from France (Paris) by means of other connecting lines yet to be constructed, but, most important of all, it will be an express route, practically level, which means fast trains and cheap freights as compared with the expensive operations of traffic over the Gotthard inclines. Had it not been for this, the tunnel might have been driven at a much higher altitude and at an enormous saving in the cost of the work. The Swiss end of the tunnel has an altitude of 2,250 feet, and the Italian end 2,076 feet, while the tunnel summit is 2,310 feet.

The practice of boring mountains at as low a level as possible is likely to become general in the near future. Already plans have been made for piercing the Ligurian Apennines, north of Genova (Italy) with a tunnel about 13 miles long, lying at a comparatively short distance below the surface, merely for the purpose of reducing existing surface gradients and thus facilitating traffic between this port and Milan, the industrial capital of Italy. The Wildstrübel in the Bernese Alps is, according to present plans, to be bored in order to connect the great international railroad center of Basel with the Simplon tunnel, and so effect a great saving of distance as compared with the detour now made by the present Simplon line *via* Lausanne and Lake Geneva.

In driving the Simplon tunnel, one of the great difficulties encountered was the influxes of hot water that occurred; first, on the Swiss side, and, later, on the Italian side. The spring cut into at the southern end of the workings could never have been dealt with from the northern side.

This spring was the most formidable one encountered, and yielded 80 liters (20 gallons) of water per second at a temperature of 46 deg. C. (114.8 deg. F.). It is located at the southernmost fringe of that great tract of subterranean water courses which had so much retarded, during the previous two years, the progress in the northern, or Swiss workings, its exact position being at 9.14 kilometers from the southern portal at Iselle (Italy). This irruption occurred on September 6. Previous to this event, the boring in No. 1 main tunnel was calculated to be finished on October 16, 1904—had it been possible to maintain the previously-existing average of 6 meters per day. Instead, however, all work throughout the various constructional sections in the main tunnel had to be suspended. To combat this inflow, the first step was to enlarge the spring's orifice in the tunnel, in order to reduce the velocity of its inrush, and then cover up the opening with thick lagging boards to keep the water out of the heading, these boards serving besides as non-conductors of heat. The flow was subsequently led off through a special drainage transverse passage between the two tunnels, the work of boring which was rushed through, in order to enable the hot water to be promptly diverted into the main drain in the No. 2 secondary tunnel. This passage, about 125 feet to the rear of the hot spring, is the forty-fifth from Iselle (at 9.1 kilometers). The irruption of this hot-water spring increased the general air temperature in tunnel No. 1 to an average of 35 deg. C. (95 deg. F.) from an average temperature previously existing of only 27.8 deg. C. (82.04 deg. F.).

The ventilating air where delivered at the heading face previous to the inflow of this hot water was only 20.5 deg. C. (68.9 deg. F.), but afterward the temperature rose to 40 and 45 deg. C. (104 and 113 deg. F.) near the springs, though it was reduced to about 28 deg. C. (83.48 deg. F.) by means of batteries of cooling sprays, the water of which had a temperature of 16 deg. C. (60.8 deg. F.). This cooling water was pumped by a centrifugal pump run by hydraulic turbines and by a 100-horse-power steam engine located in the tunnel, the pumps taking their supply from a large spring of cold water, which has been canalized in the tunnel about three miles farther back, where it occurs in cross passage No. 21A at 4.4 kilometers.

The spring mentioned has a temperature of 12 deg. C. (53.6 deg. F.) and a natural pressure at the rock outlet of 80 pounds per square inch. It is tapped by a 253-millimeter (9.96-inch) pipe surrounded with a jacketing of broken charcoal for keeping down its temperature, and this natural head of the water for a long time served all requirements for spraying the atmosphere.

Spraying heads located in each of the rearward transverse passages of tunnel No. 1 were used for cooling the air, and a special plant consisting of long perforated pipes, adjustable to all positions, was used as at the Swiss end, for cooling the rock. In encounters with new hot springs in the northern or Swiss headings, the most efficacious method of preventing the hot water seriously raising the temperature of the air was to project a large volume of cold water right into the aperture from which the hot water issued, thus reducing the heat of the inflowing water from the very first. While this was going on, the aperture was excavated as rapidly as the conditions permitted, in order to reduce the velocity of the inrush, which was often such as to throw the water to a distance of sixty feet, and sometimes cause it to hurl pieces of rock that would occasionally wound a miner. After enlarging the orifice, planks were driven in vertically against the walls, and with other planks lapping their joints, the water was shut in and drained off into a deep channel or well, whence it was pumped to the top of the incline into the large channel drain of tunnel No. 2 of the north heading.

At the Swiss, or north, end of the tunnel, both headings were still full of hot water up to the time the headings were burst through. No. 1 main tunnel was filled for a length of 253 meters (835 feet) and No. 2 auxiliary tunnel for a length of 23½ meters (77½ feet), these distances being measured from the iron safety-gates which were finally erected across the tunnel in March, 1904, in view of the possible encounter with further hot-water springs than those which had been met in the autumn of 1903.

After this time very little advance was made in tunnel No. 2, as it received all the water coming from the two headings; but No. 1, notwithstanding that the atmospheric heat had risen from 23 deg. C. to 31 deg. C. (73.4 deg to 87.8 deg. F.) was still driven on 199 meters (656.7 feet) during the last three months of the work and with an average sectional area of 6.1 square meters (65½ square feet). The progress of boring the main tunnel in the month of May was exceptionally good, varying from 2.20 meters (7.21 feet) to as much as 5 meters (16.4 feet) per day and averaging altogether 3¼ meters (10.66 feet) daily. In the last 200 meters (660 feet) the rocks traversed were exclusively of silicious and micaceous crystalline limestone, of gray and gray-white color, with seams tending uniformly north to west from 15 deg. to 20 deg., the stratifications occurring in regular layers up to the last 90 meters, whence they were tumbled and broken and accompanied by secretions of calcite. Across the strata west to east were fissures which coincided with the great infiltrations of hot water.

Another of these was cut into at advance point 10.376 kilometers. It yielded 35 liters (9¼ gallons) of water per second at a temperature of 44 deg. C. (111.2 deg. F.). At this time (May 18) the hydraulic power for the pumps was found insufficient to deal any longer with all the infiltrations, including also the large quantity of cold water forced into the heading for indispensable cooling purposes. Hence an order was given to shut the flood gates. In order to reduce the pressure, discharge pipes were placed in these doors, through which there was a considerable flow of water. At the north portal this amounted to 146 liters (51¾ gallons) per second.

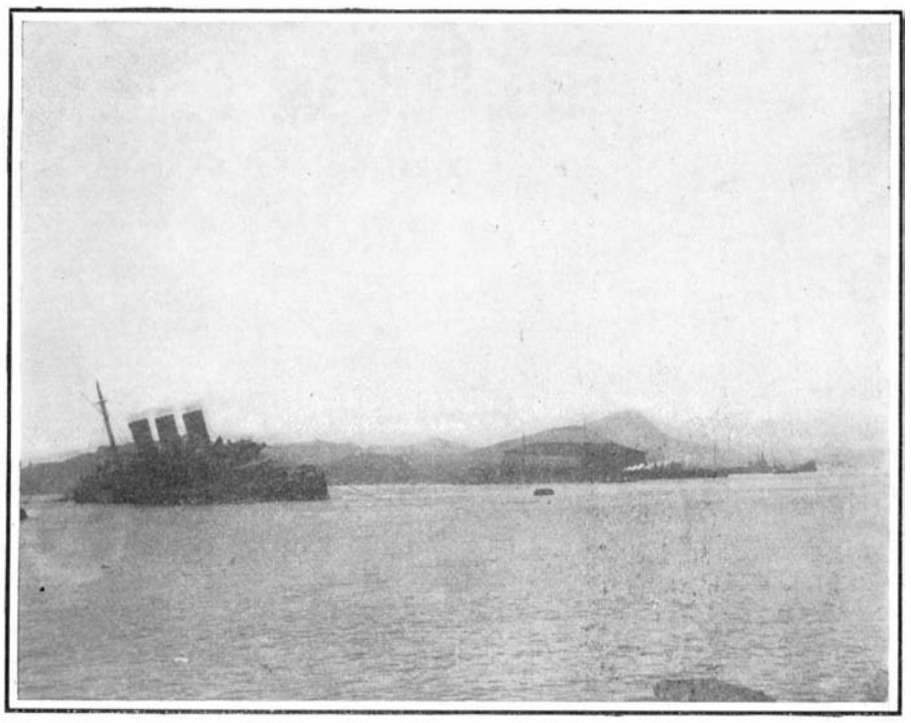
The chances of success at the southern side of the boring were much greater, for there the whole grade of the tunnel throughout (of 7 per 1,000) rendered drainage pumping unnecessary, and the lesser temperature of the rock, which prevailed up to September 6 last in the Italian headings, enabled the refrigerating water to be brought to the front without the difficulty and need for voluminous non-conducting jackets for the pipe lines, such as were obligatory at the north end of the tunnel for two years past, and, more recently, in the Italian workings.

From this end the work was followed regularly with an average advancement of about five meters per day. Apart from the important springs met at 4.5 kilometers from the Iselle entrance, the springs of water were small and did not seem to form any great obstacle to work. The 6th of September the head of the main southern gallery was 9,110 meters from the southern entrance at Iselle and there were only 244 meters more to be tunneled in order to reach the abandoned north tunnel. At 10 A. M. there appeared in the calcareous schists being traversed a spring supplying 100 liters (26.41 gallons) per second, and whose temperature was 45 deg. C. (113 deg. F.). The temperature of the rock was 42.5 deg. C. (108.5 deg. F.). The work had to be stopped, and a transverse tunnel connecting the two tunnels was then constructed, so as to allow the hot water to flow out through the main tunnel by means of a lateral canal along the walls of this tunnel. The flow of this hot spring was then concentrated at a single point.

In order to diminish the temperature, which stopped the men from working, the tunnel was cooled with jets of cold water. After the two parallel south tunnels had been connected at this point, a delay of three months sufficed to achieve the work of enlargement. When this was accomplished, the heading was pushed forward with all possible speed, with the result that the juncture of the south and north tunnels was finally accomplished on February 24, and the great volume of water accumulated in the headings of the north tunnels was tapped, and allowed to flow down through the south tunnel into the Diveria River. To accomplish this result has taken six and one-half years and the expenditure of $15,700,000. The best rate of advance of a single heading was 500 to 700 feet per month in dense granite rock. A more detailed illustrated description of how the tunnels were bored, and how the many difficulties met were overcome, will be published shortly in the SUPPLEMENT.

PORT ARTHUR AFTER THE CAPITULATION.

In our issue of January 14 we told the story of the bombardment of Port Arthur and the sinking of the Port Arthur fleet, as seen from the standpoint of the Japanese mortar batteries, which were one of the main instruments in bringing about the final capitulation. We gave illustrations of several of these batteries, and a description of the mounting and working of the mortars, and the method by which, as the result of the capture of 203-Meter Hill, the Japanese were able, by observing the fall of the shells, to direct the high-angle fire. In the present issue we present a series of most interesting views, showing the work of this bombardment as viewed from within the great circle of forts that for so many months served to hold the enemy at bay. One of our views shows the sunken wreck of the "Peresviet," one of the best-known, and certainly one of the handsomest of the Russian battleships. This vessel, which is of 12,674 tons displacement, was a sister to the "Osliabia," which now forms part of the Baltic fleet under Admiral Rojestvensky. She was launched in 1898, and carried four 10-inch and eleven 6-inch guns, besides a score of 3-inch rapid firers. She had two submerged and four above-water torpedo tubes, and is credited as having made on trial a speed of over 19 knots. A sister ship, the "Pobieda," also lies sunken within Port Arthur harbor. Another of our photographs shows the torpedo transport "Amur," one of two vessels that were built especially for the purpose of laying mines. She was a vessel of 2,500 tons and a speed of 18 knots, carrying a light armament of five 12-pounder guns. She was constructed with large ports through her stern, out of which she could run submarine mines by means of an overhead trolley, that could be extended through the ports. As soon as the mines were clear of the ship, they were dropped, one after the other, until a long line of them was laid across any desired channel. It will be remembered that this vessel ran out and laid the mines, ten miles off shore, by which the battleship "Hatsuse" was lost, as described in our previous issue. At the opening of the war there were two vessels

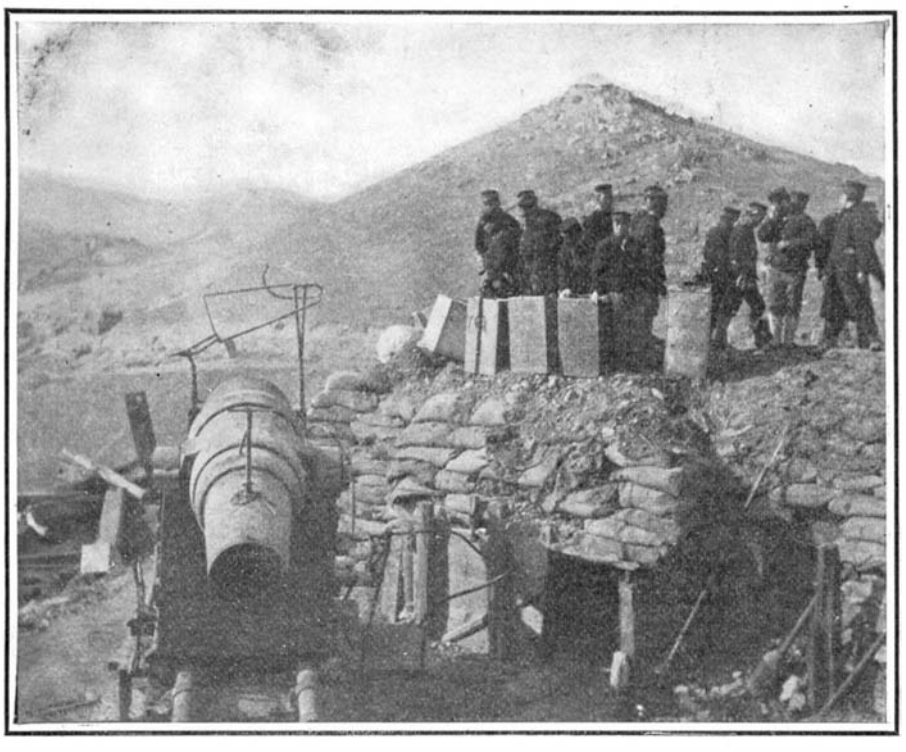


Battleship "Peresviet," Sunk in the Inner Harbor.

Torpedo Transport "Amur," Sunk at the Docks.

Carriage from Which Gun Has Been Blown Entirely Away.

Heavy Mortar on an Improvised Foundation.



Photos. by Edwin Emerson, Jr.

Seacoast Mortar, Protected by Sandbag Emplacement.

Three-Inch Field Gun Wrecked by Shell Fire.

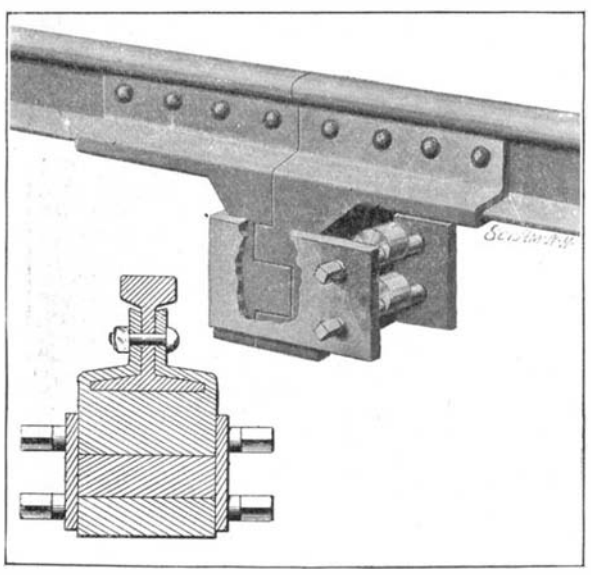
of this type at Port Arthur; but soon after the opening of the blockade, the sister ship "Yenesei" either struck a mine or was blown up by the premature explosion of one of her own mines. The "Amur," however, was more successful, and, indeed, she struck the most serious blow of the whole war in the sinking of the 15,000-ton "Hatsuse," which was one of the finest and most modern of the Japanese warships.

When it became evident to the Russians that Port Arthur was doomed, they sank such of the ships as had not been destroyed by the Japanese mortar batteries, and with a view to rendering the docks and slips useless, they sank the "Amur" and other ships, inside the dock or at the slips and blew up the dock caisson. One of our photographs shows the "Amur" sunk and lying heeled over on her starboard side. The work of the explosives is distinctly visible on her bridge and decks, marking the havoc either of the Japanese shells or of charges of high explosive used by the Russians to render the ship impossible of salvage.

Subsequently to the surrender of Port Arthur, Gen. Stoessel has referred more than once to the terrific effect of the 11-inch high-explosive shells. He states that it was quite impossible to find any protection against these, the bomb-proofs and the heaviest parapets and emplacements being utterly wrecked by their explosion. To be convinced of this, it is only necessary to look at some of the photographs taken in the forts and at various gun positions, after the capitulation. It will be noticed that not only are the guns dismounted and the carriages blown to pieces, but the very earthworks and massive concrete foundations and parapets have been blown up, torn apart, and scattered in a perfect chaos of wreckage. This is particularly noticeable in the photograph showing an empty gun carriage. In this case the shell hole by which the projectile entered is distinctly visible in the steel plating, and evidently, as it burst beneath the gun, it lifted the massive piece entirely from its trunnions, and threw it so far as to be out of range of the camera. Other views show some of the heavy ordnance, probably 10-inch of the Krupp pattern, Port Arthur containing a large number of guns from the Krupp works. One of these is apparently a howitzer, and the other a mortar for high-angle fire, of the same general type as that used by the Japanese. It will be noticed that a free use was made of sandbags in building emplacements and shelter for the gun positions. It must be admitted that the havoc shown in these illustrations appears to verify the most dramatic descriptions that have reached us from the various correspondents who have visited Port Arthur since its surrender.

A NEW TYPE OF RAIL JOINT.

In the accompanying engraving we illustrate a rail joint designed to connect the abutting extremities of two rails without the use of bolts or nuts. The device comprises two jaw members adapted to be fitted on to the rails, and a clamp for drawing and securing these members together. The latter are each formed with a body portion, from the top of which flanges project upward, closing over the base of the rail, as indicated in the cross section. The body portions are provided with projections arranged to interlock when the members are drawn together. The clamp consists of a plate bent to U-shape, and adapted to be fitted over the body portions of the two jaw members. Mounted in the open end of the clamp are two shafts, each formed with an eccentric swell. The ends of these shafts are

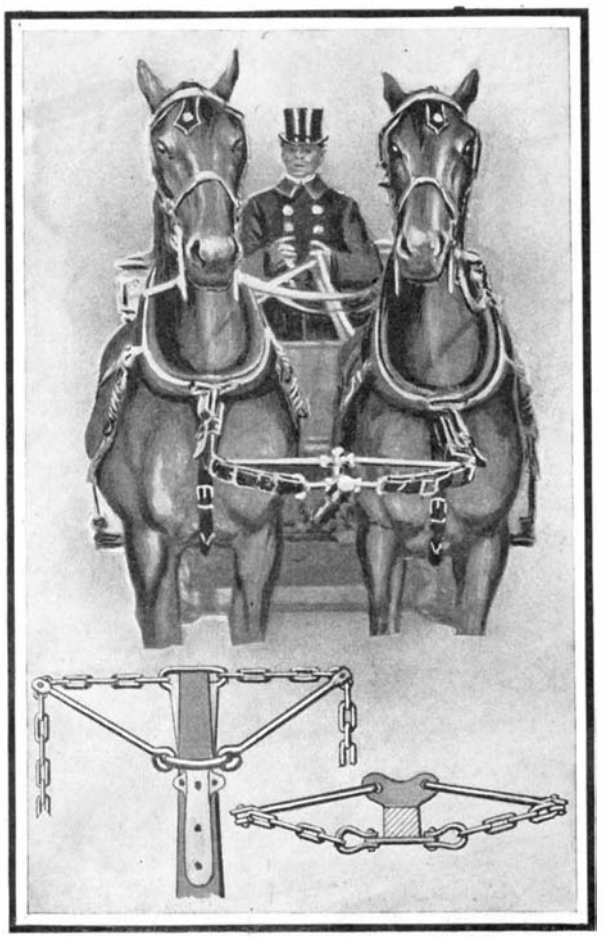


A NEW TYPE OF RAIL JOINT.

squared, so that they may be rotated by the application of a wrench, when the cam swells will press the jaw members firmly together. To prevent creeping of the rails, bolts may be passed through the flanges of the jaw members and the rail webs; but the joint proper, it will be observed, is made without the use of bolts, screws, or wedges, and can be very quickly connected or disconnected by means of a wrench. The body portions of the jaw members make a very solid support for the ends of the rails, thus doing away with the pounding and wear common to all railways in which no metal supports are provided for the joints. A patent on this rail joint has recently been granted to the inventor, Mr. William J. Forsythe, of Teotillan del Camino, Oaxaca, Mexico.

IMPROVED BACKING HARNESS FOR TEAMS.

There are some inventions which at the very first sight excite surprise that the older forms which they displace should not have been abandoned long ago. The improved backing harness shown in the accompanying engraving, which has been patented by Mr. T.



IMPROVED BACKING HARNESS FOR TEAMS.

H. Brigg, 3 Park Grove, Shipley, England, represents a very successful attempt to get rid of the serious disadvantages attending the old method of harnessing a team by a strap, running diagonally from the collar to the end of the pole—a method which, because of its unscientific and clumsy features, should have been abolished long ago. In moving any object either by pushing or pulling, if we wish to utilize the power to its full effect, it must be applied in the line in which the object is to be moved. Moreover, if the power be applied obliquely to the line of motion, there will be a loss of power proportional to the angle thus formed between the line of motion and the direction in which the power is applied. In the old method of harnessing, the obliquity of the pole strap to the pole renders it necessary for the horses, in backing to a curb, or in retarding a heavy load on a down grade, to throw their bodies well away from the pole. This is a bad arrangement for two reasons: First, that the team is not pulling in the direction in which the load is to be moved or retarded, and therefore a certain percentage of their energy is wasted; and, secondly, the outside forelegs and the outside shoulder muscles of the team are subjected to twisting strains that are injurious to the horse and prevent him from using his strength to the best effect. The backing harness herewith illustrated effectually remedies these two defects of the old system. The pull in backing is directly parallel with the pole; it is therefore no longer necessary for the team to throw themselves away from the pole, and they are enabled to exert their power in a natural position, in the proper direction, and therefore to the best effect.

The device consists of a pair of strong pivotal arms, which are attached to a clamp bolted above the pole a short distance from its outer end. Attached to their outer ends are two lengths of chain or two straps, one of which is connected to an eye-piece attached at the forward end of and beneath the pole, and the other to the ring of the horse's collar. When the horses are pulling forward these arms hang loosely, and therefore will not strike the horses' heads when the pole is jerked sharply upward on uneven roads. When the horses begin to back, the arms swing upward until the forward lateral chains are taut, and each horse is thereby enabled to exert a direct pull parallel with the pole. The device has been applied with equal success to light pleasure vehicles and heavy commercial conveyances such as trucks, wagons, and drays.

A Huckleberry Growing 165 Feet in the Air.

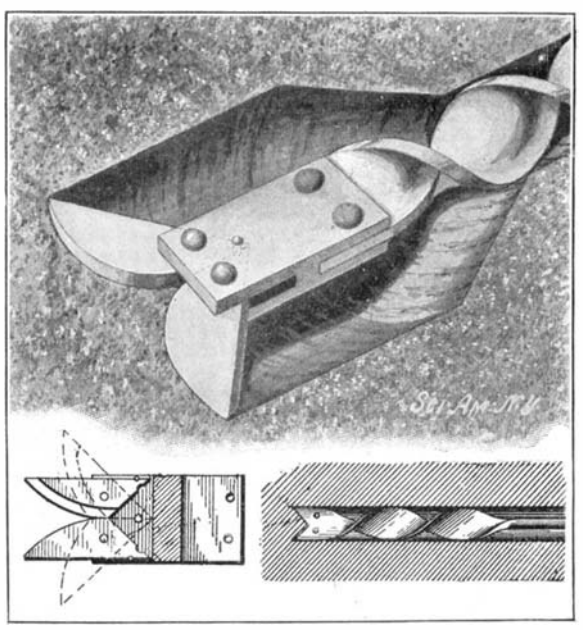
At Brookdale, Santa Cruz County, California, a fine but shallow-rooted specimen of the Sequoia, or California redwood, was blown over in a recent storm. The tree is estimated to be over 330 years old, measures 175 feet from butt to tip, and 60 feet in circumference. Ten feet from the top of the tree, and at a distance of 165 feet from the ground, was found a hole somewhat less than 2 feet deep. It had once been the nest of a woodpecker. In this hole had grown a sturdy, three-stalked huckleberry bush, 2 feet tall. Its roots, extending 6 feet into the heart of the tree, had absorbed the sap of the redwood. Decay had set into the tree, but the huckleberry had flourished, flowered, and borne fruit. The common theory is that the huckleberry seed had clung to the moist side of a tan-oak acorn, and was thus carried by the woodpecker to his nest. It is evident from the gnarled, woody stalks that the bush is many years old. The shrub has been topped and transplanted to the native soil of its species, but it has sickened and is already shedding its leaves.

To Prevent Rails from Spreading.

An ingenious device, the scope of which is to prevent railroad metals spreading under the influence of atmospheric heat, and thereby eliminate accidents attributable to this cause, has been designed by Mr. G. W. North, traffic manager of the North Wales Narrow Gage Railway. The contrivance comprises a flat iron bar which is attached over the ties but under the metals. There are two iron struts fitting outside the rails and under the shoulder forged on the bar. The struts are at an angle, and constructed so as to fit the bottom outside flange of the rail. Inside the rails there is a clip piece of wrought iron fitting closely over the inner side flanges, having struts on both inner and outer rails, so that on any curve the railroad cannot spread outward or the gage become altered. The danger on railways, especially on curves, is the tendency of the rails to spread at the head, thus widening the distance between the rails, and unless constant vigilance is maintained at such points, a derailment is bound to occur sooner or later.

REAMER FOR ENLARGING BLAST HOLES.

In mining operations, where holes are bored for the purpose of blasting, some of the efficiency of the blast is lost by the escape of gases at the time of the explosion, through the opening leading to the surface. It has been sought to overcome this difficulty by enlarging the bore of the hole at the bottom where the explosion takes place, so as to afford a relatively restricted outlet, which conduces to a more complete inclosure of the gases generated. The accompanying engraving illustrates a reamer, which may be attached to the ordinary drill for thus enlarging the hole. The device consists of two cutting blades or bits pivotally mounted in a frame, which is provided with a socket for the reception of the end of the drill, to which it is secured by screws. The bits are of approximately triangular shape, terminating in sharp points at their outer extremities. In practice a hole is first drilled with a common drill. These drills are usually formed with oppositely-disposed separated points, which form a conical base or nipple at the bottom of the opening. When the reamer is applied to the drill, the bits pressing against the conical base are forced outward, so



REAMER FOR ENLARGING BLAST HOLES.

that in their rotation they will form an enlarged chamber, as indicated in the illustration. When the chamber has been reamed out to a sufficient depth, the drill and reamer may be readily withdrawn, for the bits will return to their normal folded position. Mr. Henry C. Bramer, of Cheswick, Penn., is the inventor of this novel reamer.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

RAKE-TOOTH CLIP.—L. L. LAUTNER and O. A. JONES, Traverse City, Mich. In the present patent the invention relates to improvements in clips or caps for securing the teeth to the angle-head of a horse hay-rake, the object being to provide a clip or cap with which either a right or left hand tooth may be engaged—that is, a tooth having its end turned either to the right or to the left. The clip of these inventors may be used at both sides of the center.

GLEANING ATTACHMENT FOR THRESHING-MACHINES.—J. HEAZLETT, Glasston, N. D. This inventor's purpose is to provide an attachment to portable threshing-machines, which attachment gleans or gathers the grain lying on the ground or in bundles while the machine travels forward through the field, the machine to which the attachment is applied threshing the grain in the ordinary way, thus rendering it unnecessary to gather the grain by means of teams and wagons and conveying the grain to the threshing-machine stationary at a fixed point.

DRAFT-EQUALIZER.—W. L. G. SCHNEIDER and F. J. EMAL, Pickrell, Neb. The aim of the invention is to provide novel details of construction for an equalizing draft force produced by four draft-animals when attached to a gang-plow or other subsoil-plow, so that both pairs of draft-animals will pull alike and the plow be under control for effective work.

FEED-REGULATOR FOR THRESHING-MACHINES.—A. G. CRITCHFIELD, Rosalia, Wash. In this invention the principal object is the provision of means for preventing too large a quantity of material being fed into the machine irrespective of the amount placed upon the feeding device itself. The invention is applicable to all kinds of threshing-machines and to other machines of a similar character. A great advantage consists in the amount of material fed to the machine being regulated when desired without stopping any of the parts.

Of General Interest.

OIL-WELL SYSTEM.—F. J. MOSER, Kane, Pa. A number of separate wells are connected together, each well being provided with a local automatic valve mechanism, the arrangement being such that one of the wells is flowed, then action at that well ceases and another is flowed, the several wells thus acting in succession. The gas or other aeriform body used in flowing may be withdrawn from the system of pipes and used again. The arrangement also tends to prevent excessive corrosion of the pipes.

BOTTLE-SEAL.—C. INGULLI, New York, N. Y. This invention has reference to a means for sealing bottles and for enabling persons readily to observe that the original closure has been broken. When the bottle is first filled with the genuine goods it may be sealed by the bottler in a peculiar manner and when this seal is once broken and the contents of the bottle decanted persons will be warned against subsequent attempts to impose fraudulent goods upon them.

BOOK.—J. E. UPSTONE, Nashua, N. H. In this case the invention relates to an improvement in that class of books in which the leaves are removable from the covers of the same, and in which provision is made for holding separate sheets in one of the covers and which may be readily removed for filing away. The holder is particularly adapted for use in connection with a system of keeping ice-accounts of drivers' routes, as the loose sheets, ruled and printed for that purpose, are to be taken out each day and filed away for future use. The bound leaves with names and addresses will remain in the holder or book the entire season.

CHESS OR DRAUGHTS BOARD AND CHESS OR DRAUGHTS MAN.—A. W. P. LIVESEY, 40 Bennett Park, Blackheath, Kent, England. The object in view in this invention is the provision of chess and draughts boards so manufactured that they can be doubled up or closed at any moment with the men standing in any position in which they may happen to be, so that in the case of an interrupted game the board can be reopened with all the men standing in the same position which they were in when the board was closed.

UNLOCKING DEVICE FOR SHUTTERS.—A. ENSOR, Jersey City, N. J. The aim of this inventor is to provide an unlocking device for iron shutters of factory, warehouse, storage house, and other buildings windows arranged in case of a fire within a building to give an alarm and to bring the controlling device for the shutter-lock within reach of the firemen or other authorized persons to permit such persons to readily unlock and open the shutters from the outside to gain convenient access to the source of the fire whenever it is deemed necessary.

SUN-DIAL.—S. M. CLARKE, New York, N. Y. This inventor's purpose is the provision of a device simply and easily constructed, while at the same time accurate and neat in appearance. The dial is intended for indoor use, as upon a window sill, and is preferably constructed of thin but stiff paper, and all portions except the translucent belt are preferably colored black, so as to prevent the passage of light except through the slot or opening.

SEALING AND LABELING CAP FOR PRESERVE-JARS.—MARION L. CURRAN, Vermontville, Mich. In this instance the improvement is in the nature of a simple, cheap, and convenient cap for sealing the tops of preserve-jars, jelly-glasses, and similar receptacles to exclude air, dust, and insects, and which is also so constructed as to be universally applicable as a label to indicate the contents of the receptacles.

STILT.—W. J. TURNBULL, New Orleans, La. In the present patent the invention relates to improvements in walking-stilts, an object of the inventor being to provide a stilt with a foot-block so arranged as to be adjusted along the stilt-staff for any desired height and rigidly held as adjusted.

COMBINED TWEEZERS AND BLACK-HEAD-EXTRACTOR.—F. J. BOEHM, New York, N. Y. Combined with the tweezers are means for expressing blackheads and the like from the pores of the skin; and the aim of the inventor is to provide an improved form of tweezers of very simple construction, having associated therewith a small tube open at one or both ends, by means of which pressure may be applied around a pore to force small masses of inspissated secretion out of the pores.

Household Utilities.

RACK.—C. BERNHARD, Canal Dover, Ohio. Mr. Bernhard's invention relates to racks, and more particularly to those adapted for the drying of clothes and like domestic purposes. It has for its principal object the provision of such a device which may be folded into compact form. The rack, while presenting all the advantages of the ordinary clothes-horse and without sacrificing lightness of construction, may be readily closed into a small compass for storage and quickly set up for use.

SHUTTER-WORKER.—DEW. M. COINER, Statesville, N. C. Mr. Coiner's intention is to provide a novel construction whereby a sprocket-chain may be utilized for opening and closing the shutters, the shutters may be supported in such manner that they may be readily operated and may be removed from the operating or working devices at will, and by which the sprocket-chain may be tightened up whenever desired.

SASH-LOCK.—I. G. FRENCH, Orange, Mass. In the present patent the invention has reference to a window-sash lock adapted to be applied to the meeting-rails of the sashes and of such a construction that it will automatically lock the sashes as they are moved into a closed position. In the operation of the device an advantage lies in means that prevent a relatively sidewise movement of the sashes and the rattling noise incident thereto.

CURTAIN-POLE.—J. KRODER, New York, N. Y. The invention refers to curtain-poles, curtain-rods, and like fixtures; and its object is to provide a fastening means for conveniently and removably attaching a knob to the end of such fixture and to reinforce the knob to allow of fitting knobs to different-sized poles or rods.

SIFTER. — H. K. BENDER, Weehawken Heights, N. J. The purpose of this inventor is to provide a construction which will be dust-proof, and wherein the receptacle for the material may be operated without any escape of dust at the opening in the casing through which the operating medium for the said receptacle extends, and wherein all the operative parts of the receptacle may be removed in order that only the body of the sifter containing the dust may be conveyed to the dumping-ground or to a reservoir and contents conveniently emptied.

Machines and Mechanical Devices.

CONVEYER AND DISTRIBUTER.—J. W. STEVENS, Trenton, N. J. In this case the improvement relates to an apparatus intended particularly for handling concrete, but useful in connection with various other materials. It comprises, generally speaking, a boom on which is arranged a conveyer, and mechanism for automatically swinging and raising the boom, so as to deposit the material handled by the conveyer at any desired point within the range of the machine.

MEAT-CUTTER.—A. W. JOHNSON, New Brunswick, N. J. This inventor provides a knife-blade quickly sharpened and mounted for movement to avoid rubbing or wearing against the cheeks or end of the bed; provides means for guiding knife-frame and for adjusting it to the end that the knife cuts slices of meat of required thickness; provides means for arresting the swing of knife-frame with minimum jar and shock on machine, as well as to reduce wear on co-operating parts of the bumpers; provides an improved form of bed by which the charge of meat is prevented from slipping out while being cut; produces a new style of follower, which can not be lifted accidentally out of operative position, and provides means for clamping adjustable meat-claw to the follower.

MASSAGE-MACHINE. — MAY CHAFFIN, Huntington, W. Va. In this instance the invention is in the nature of a novel massage-machine for applying a vibratory or frictional massage to various parts of the body and also for cleaning the teeth, and which device is so constructed as to be capable of easy attachment to and operation by the ordinary family sewing-machine.

LEMON-SQUEEZER.—P. MCGRATH, Hibbing, Minn. In the squeezer devised by this inventor, a pinion on a handled shaft operates two racks in opposite directions, one of which carries a cup for receiving the lemon and the other a cover for the cup and plunger. When the cup and plunger are moved toward each other the lemon is squeezed and the juice finds outlet through grooves in a removable plug in the cup bottom, to a tumbler held beneath the cup.

Prime Movers and Their Accessories.

BOILER-FLUE CLEANER.—F. W. JACKSON, Needles, Cal. Mr. Jackson's invention relates to an improvement in cleaners for boiler-flues which while susceptible of general use in connection with boiler-flues is particularly applicable in oil-burning locomotives. In funnels in general use and in cleaners of this type the sand frequently goes all in a lump, and when the exhaust from the engine is light a large part of the sand falls in front of the oil-burner, generally set very low, and this sand immediately forms into heavy carbon. The inventor overcomes these objections by feeding and mixing atmospheric air with the sand as it is drawn from the funnel.

BOILER-CLEANER.—F. D. MCMILLAN, Atlanta, Ga. In this patent the invention is an improvement in devices for use in cleaning steam-boilers or other closed receptacles and by which to blow out any accumulations of mud or other semisolid matter from the various parts of the boiler and to make it possible to reach corners and all other points in the boiler by water or other liquid, sand, paints, dust, air, or other fluids as may be desired.

ROTARY ENGINE.—C. F. ULRICH, New Haven, Conn. In the present patent the invention has reference to improvements in rotary engines, the inventor's object being the provision of a motor of this character of comparatively simple and inexpensive construction and by means of which the motive agent, such as steam, will be economically used.

Railways and Their Accessories.

STAKE AND STAKE-HOLDER.—C. W. SMITH, Makaweli, Kauai, Hawaii. The invention pertains to improvements in stakes and stake-holders, particularly for use on sugar-cane cars, but adapted for use on other vehicles, the object being to provide a detachable stake and holder that cannot be destroyed by fire or easily lost and that is not liable to be stolen, thus providing a much more economical device than the usual wooden stakes which are often left in the field and destroyed with burning trash or stolen and used as fire-wood.

OILING DEVICE.—W. A. HUFF, New York, N. Y. Mr. Huff's invention pertains to a device for oiling bearings, and while it is especially applicable to the oiling of car-axle bearings it is capable of use upon any other kind of a bearing. The object of his improvement is to provide for a ready and continuous flow of oil from a pool of oil to a bearing. For this purpose the inventor makes use of centrifugal force.

DEVICE FOR CHANGING RAILWAY STOCK-CARS FROM SINGLE DECK TO DOUBLE DECK, AND VICE VERSA.—H. C. CARSON, Cheviot, Ohio. The invention is an improvement in stock-cars, being in the nature of devices whereby the car may be readily changed from single deck to double deck, and vice versa; and an object is to provide improvements in construction of the stock-cars whereby a removable second floor or deck may be employed in a railway stock-car above the ordinary floor and which shall be practical, durable, strong, and cheap, and will operate to make the car so constructed safer and stronger with the improved devices than it would be if the same were omitted.

Pertaining to Vehicles.

VELOCIPEDE.—F. M. THOMPSON, East Liverpool, Ohio. This improvement is in velocipedes, being in the nature of a combination, with a carriage in the form of a sulky, of the figure of an imitation horse, having legs connected with the propelling devices of the carriage in such manner as to be operated as the carriage is propelled, and the legs being so formed as to simulate the action of a horse.

CUSHION-TIRE-ATTACHING MEANS.—MARY E. BROOKE, Denver, Col. The invention is an improvement in that form of composite tire for bicycles, automobiles, and the like, which consists of an inner member and an outer inclosing member, and means connected with the latter for holding both duly engaged and secured to the wheel-rim. Certain improvements are devised in the construction and arrangement of parts, whereby a stronger and more durable composition tire is produced and securely attached to the wheel rim.

TIRE.—C. MILLER, Binghamton, N. Y. The inventor devises means for securing the casing and core to rim of wheel retaining the cushioning effect of the tire and yet preventing creeping and movements tending to displace or disturb proper position of tire on the rim. He attains this by employing, in addition to usual side clamps, an interior clamping device, which coacts with side clamps in holding the casing and elastic core. Preferably the clamping device comprises two strips of wood or other material which bear on sides of a longitudinal rib on the core and between sides of casing, said parts being pressed laterally together by side clamps and strips drawn in against the rim by radial fastenings passing therethrough.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 6616.—For parties to manufacture dies and small sheet metal parts.

We manufacture iron and steel forgings, from twenty pounds to twenty-five tons. Crank shafts of all varieties. Erie Forge Company, Erie, Pa.

Inquiry No. 6617.—For machinery for crushing linseed and cottonseed, and refining their respective oils.

I have every facility for manufacturing and marketing hardware and housefurnishing specialties. Wm. McDonald, 190 East Main St., Rochester, N. Y.

Inquiry No. 6618.—For manufacturers of machinery for making shuttles as are used in cotton mills.

Sheet metal, any kind, cut, formed any shape. Die making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6619.—Wanted, a machine for making single-loop hay bale ties.

The SCIENTIFIC AMERICAN SUPPLEMENT is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6620.—Wanted, addresses of dealers in canning machinery.

General Utilities Company, 60-62 Liberty Street, N. Y., offers unusual facilities for placing inventions and devices of merit before the public. Correspondence invited.

Inquiry No. 6621.—For manufacturers of a process for extracting oil from raisinseed or olive pomace.

We manufacture gasoline motor and high-grade machinery, castings best quality gray iron. Select patterns, and let us quote prices. Frontier Iron Works, Buffalo, N. Y.

Inquiry No. 6622.—For makers of ice cream machines of 25 or more gallons' capacity.

WANTED.—Colonial silverware. Any one wishing to sell any authentic silver made in this country during the eighteenth century, please communicate with C. A. M., Box 773, New York.

Inquiry No. 6623.—For the manufacturers of the Brown Cochran Carbonic Ice Machine.

VALUABLE PATENT FOR SALE.—An indispensable article for women. Has large demand in all department stores. Patent No. 774,191. Address Acme Hygienic Co., 132 West 90th Street, New York.

Inquiry No. 6624.—For manufacturers of machines for desiccating cocoanuts and other necessary machinery for a cocoanut plant, as slicing, shredding, grating, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6625.—For makers of paper tape such as used in stock machines, telegraph instruments etc.

Briquetting of coal, peat, sawdust, ores or any waste. Artificial fuel machinery. $3 per H. P. per year from peat. Fuel, $1 per ton. Descriptive circular free. Julius Bordollo, Kingsbridge, New York City.

Inquiry No. 6626.—Wanted, a machine for perforating pianola music rolls.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 6627.—For makers of marine engines, h. p. from 20 to 300 single, compound and triple expansion.

You can rent a well equipped private laboratory by day, week or month from Electrical Testing Laboratories. 548 East 80th Street, New York. Absolute privacy. Ask for terms and facilities.

Inquiry No. 6628.—Wanted, a machine for cutting out envelopes.

WANTED.—Articles to manufacture requiring heavy iron casting, where little or no machine work is involved. Will purchase or manufacture under royalty. Eureka Foundry Company, Rochester, N. Y.

Inquiry No. 6629.—For manufacturers of sheet iron or steel powder kegs in which blasting powder is usually shipped.

Business and Personal Wants.

(CONTINUED.)

VALUABLE U. S. PATENT FOR SALE.—I will dispose of the American rights of my Patent Thill. A necessity for farmers and drivers. Price reasonable. Address Harry Turner, Koolunga, South Australia.

Inquiry No. 6630.—For the address of the manufacturer of Golden's all metal weather strips; or for makers of any other weather strips.

Manufacturers of Hardware Specialties Contract, Manufacturers and will market articles of merit.
Larimer Manufacturing Company,
153 S. Jefferson Street, Chicago, Ill.

Inquiry No. 6631.—For apparatus for making and burning charcoal.

We Manufacture on Contract anything in light Hardware. Write us for estimates. Edmonds-Metzel Mfg. Co., 143-153 South Jefferson Street, Chicago.

Inquiry No. 6632.—For a machine for sifting sand and gravel, also for lifting the same into cars at height of 20 to 30 feet.

FOR SALE.—Modern Brush Plant, Solid Back Machines, Woodworking Machinery. Everything complete. Will sell entire plant including buildings and real estate, or any portion of the equipment. Address Plant, Box 773, New York.

Inquiry No. 6633.—For makers of the silver or "G" strings for violins, guitars, mandolins, banjos, etc.

Patent No. 777,363, 13th of December, 1904, regarding conveyor-band, consisting of metal rods, arranged one behind the other. Hitherto the ends of these metal rods have been connected by drain-links or the like. Offers solicited by Habicht, Braun & Co., 177 Franklin Street, New York.

Inquiry No. 6634.—For makers of woven wire pillows.

FOR SALE.—A Manufacturing Article of Very Great Merit.—Well protected with patents; mechanical details of manufacture all worked out; reasons for selling, profitable business in another line taking up all of owner's time. A fine opportunity for engaging in a lucrative business. Address
D. W., Box 773, New York.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9553) S. F. B. asks: Please be so kind as to inform me what alteration should be made in the winding of the 8-light dynamo in order to make it suitable for lighting 110-volt 16-candle-power lamps. Also which of the two armature cores is the better, and do you consider this dynamo a practical electric lighting machine, and do you have the plans for a more up-to-date machine for electric lighting of about the same capacity? A. The 8-light dynamo is a practical machine, even now, seventeen years since it was designed. Many of them are in operation and doing their work well. We have not published the plans for any other machine of this size. The armature composed of sheet iron disks is much to be preferred to a wire-wound armature core. Some very good alterations have been made in this dynamo by certain parties who have built it. These are described in answers to queries No. 8250 and 8316. These you may have if you have kept the back numbers of the paper. To make a 110-volt shunt-wound machine from the same castings for the armature use No. 22 B. & S. cotton-covered magnet wire, 24 coils of 25 turns each; for the field use No. 23 B. & S. cotton-covered magnet wire, 3,640 turns on each magnet. A resistance box to regulate voltage should have about 200 ohms.

(9554) H. G. R. says: Can you tell me what is generally considered to be the proper degree of humidity for rooms in a dwelling house? The hygrometer in my house varies from 20 to 40, even when I evaporate water on the registers. The house is heated by a hot-air furnace in which is a receptacle for evaporating water, but this does not seem to have much effect. Can you suggest an easy and practical method of getting the right degree of moisture in the air and of maintaining same? A. There is no recognized degree of humidity which is regarded as better than any other. It is usually considered that a very dry atmosphere is more healthful than a damp one, and the opinions of physicians differ regarding the value of increasing humidity in dwelling houses during the winter by the evaporation of water. The only ground on which the practice can be justified is that it may tend to make the variation of humidity in the atmosphere of the dwelling less from day to day than would otherwise be the case.

(9555) C. K. K. asks: I want to silver-plate on wood or other substances. Have you any reasonable-priced book on this subject? Electro-plating, I presume it is termed. A. Electro-plating on wood does not differ from plating on any other material electrically. It is necessary to coat the wood with some material impervious to water, and then cover it with plumbago to render the surface a conductor of electricity. Soaking the wood in hot paraffine may close the pores so that it will not soak water, and the paraffine will take the plumbago very well. The plating process is well described in the book "Modern Electro-plating," by Van Horne, which we can send for $1. Another method for coating a surface and making it a conductor is given quite fully in answer to Query No. 8661, Vol. 87, No. 7.

(9556) J. E. W. asks: Would you please explain through your columns how an incandescent lamp is made, and what materials are used in electric lamps, and how is the vacuum put in the globe? A. The making of an incandescent electric lamp involves a great many processes. The glass bulb is blown, and the several parts which can be seen from the outside are each made by different hands and fastened in their several places, thus forming the lamp as it is finally used. Upon the large end of the bulb is a piece of glass tubing by which the lamp is connected to an air pump, and the air in the bulb is finally pumped out, thus producing the vacuum. The vacuum is not put into the lamp, but the vacuum is made in the lamp by removing all the air. A full description of the making of a lamp may be found in our SUPPLEMENT No. 1377, price ten cents.

(9557) G. W. N. asks: Will you kindly inform me if there is a non-freezing solution for cooling gasoline engines? I have 4½ horsepower with 25 gallon tank. Also what chemical effect, if any, same has on the castings? A. There are three common methods of keeping water in the cooling coils of automobiles from freezing. 1. Use a mixture of four parts water and one part wood alcohol. The difficulty with this method is that the wood alcohol tends to evaporate out from the water and has to be replaced from time to time. 2. Use a nearly saturated solution of calcium carbonate. The difficulty with this solution is that it has a slight tendency to corrode the metal it comes in contact with. 3. Use a mixture of four parts water and one part glycerine, to which should be added about one pound of ordinary washing soda for every ten gallons of the mixture, to correct a slight tendency toward acidity from the glycerine. It is possible to freeze any one of the above mixtures if the temperature is sufficiently lowered, but none of them is likely to freeze at a temperature above about zero Fahr. Any one of the three mixtures will give satisfactory results, but in our judgment perhaps the third is the best. If a mixture is desired for a temperature below zero degrees, we would recommend adding wood alcohol to the third mixture. While we have had no experience with this, we believe it would give good results.

(9558) D. L. G. asks: Being a subscriber to your paper, I will ask a few questions. We receive a bundle of paper here every week, and once in a while it becomes electrified, it attracts other paper. How does this become electrified? Where does it get its electricity? Does the turbine wheel resemble a Pelton wheel? Are the turbines they use in boats like the Pelton waterwheel? A. Paper is easily electrified by friction in cold and dry weather, so the paper bundle by being tossed about and rubbing against other things becomes electrified. It does not need to get electricity from anywhere outside of itself. There is electricity in everything, and anything we do to produce electricity, as we call the operation, only causes the *manifestation* of electricity, which was in the thing before we made it manifest itself. We do not call any electricity into existence, we can only make visible the presence of electricity which was not visible before. The steam turbine acts on exactly the same principle as the Pelton waterwheel, the only difference being that the steam turbine has a very large number of small buckets, and the steam which acts on them enters the buckets at an angle instead of at right angles to the axle of the wheel, and at as many different points as there are buckets in the circumference of the turbine. Also with the steam turbine there are a number of rows of buckets mounted on the same shaft, and the steam after leaving one set of buckets passes fixed vanes which alter its direction before it reaches the second row of buckets. In this way the steam turbine is like a compound Pelton wheel having a number of wheels parallel with one another on the same shaft, arranged in such a way that the water passes through one after leaving another.

(9559) G. C. E. asks: Have you any back numbers telling how a telephone transmitter is made, both carbon and induction, and which is counted the best, say for a two-mile line, and why? Same in regard to receiver. Could a battery be used in place of magnets for call, and how many cells with twelve galvanized line wire? Same with copper wire? Is metallic circuit necessary, or can one wire grounded at each end do? I mean for the telephone. Are both receiver and transmitter necessary, or can one be used for both purposes for that distance? Also, I wish to know how to make a microphone, or number of paper describing same. A. We have published in our SUPPLEMENT, No. 966, and in the SCIENTIFIC AMERICAN, Vol. 72, No. 4, full descriptions for the making of a carbon telephone transmitter and induction receiver. The two are not used at present, interchangeably; the receiver can be used as a transmitter, but the action is so poor that no one would think of relying upon it in regular service. A bell rung by a battery can be used for a call, as well as to ring the bell by a magneto. The number of cells will depend upon the manner in which the line is put up. Probably four to six will ring the bell; if not, add more. One would not put up a copper line for so short a distance and not very frequent service. In the country, away from other electric lines, a return wire is not needed; but if the line passes near other electric lines, a metallic circuit is necessary. A microphone is made by arranging two pieces of carbon so that they are loosely in contact. A current of electricity sent through the poor joint is varied by the changing pressure of the pieces of carbon upon each other. A great many forms of this have been devised. SUPPLEMENT No. 163 gives figures and description of several forms. SCIENTIFIC AMERICAN and SUPPLEMENT copies are mailed on receipt of 10 cents each.

(9560) P. R. J. says: Give process for mounting ordinary newspaper cuts so that they may be used as lantern-slides. A. Newspaper cuts cannot be mounted so that they can be used very satisfactorily as lantern slides. The best way to prepare them is by coating the picture with varnish; a fine spirit varnish should be used, or a negative varnish might answer. Rub the print face down on the glass until all air bubbles are expelled. When dry soak the paper with water, and rub the paper off the glass very carefully with the finger, so as not to remove the varnish and ink of the picture. If successful, the picture will remain on the glass when the paper has been removed. In Hopkins' "Experimental Science" you will find a description of a method of projecting pictures and solid opaque objects directly upon the screen without transfer to glass. Photographs can thus be projected with good effect. It is much better than any transfer of a picture to glass.

(9561) A. F. S. asks: What is smoke in terms of molecular physics? Is it composed of single molecules of carbon or flakes of the same, or is it a fixed chemical compound combustible or gas modified by carbonic acid? A. The visible portion of smoke is the unconsumed carbon which has passed up the chimney and is lost to the fire. It is not in molecular particles, but in masses, as any one may know who gets it into his eyes. Molecules are too small to be perceived with any of the senses. When the smoke is consumed, the gases which escape from the chimney are invisible to the eye, since they contain no solid particles. The carbon is then changed into carbon dioxide—carbonic acid gas.

(9562) A. F. D. says: When I stand before a mirror, with outstretched arms, I observe that my hands are reversed—an object held in my right hand appearing in my left in the mirror. Why are not my head and feet also reversed? A. Your head and feet are reversed in a plane mirror in exactly the same sense as your hands are; that is, the image which you see in the mirror will wink its left eye if you wink your right eye; its left foot is opposite your right foot and is an image of your right foot, etc. The entire image of yourself as seen in a plane mirror is a reversal of yourself; it faces in the opposite direction to that in which you are facing, and looks you in the face. Your outstretched arms and hands are not upside down, in the image, and yet you seem to ask that your head and feet should exchange places and your image be seen standing on its head. This cannot be, in fairness. The image is an optical counterpart of yourself, and because it faces you, its right hand is opposed to your left hand; its right cheek and foot are opposite to the same members of your body. Each point of the image is formed by lines which enter the eye after reflection from the mirror. The image is a geometrical construction. The method of making an image can be found in all the textbooks of optics, and need not be given here; but the idea that there is any reversal in the hands which is not also to be seen in the head and feet, is quite correct. Your image in a mirror could not possibly face in the same direction as you do, so that you could see its back, as you would that of a man who stood in front of you and faced in the same direction as you did.

(9563) E. A. W. asks: Please state in your column of Notes and Queries what substance or material the coil spring is made of in the little hygrometer made in Germany. A. We have no idea to what hygrometer you refer in your inquiry for the material a little spring is made of. If it does service as a spring, it is doubtless made of steel or bronze. It is too indefinite to ask for a hygrometer made in Germany. Many forms are made there.

(9564) G. W. P. asks: I am desirous of finding something about reversing the image by development in a photographic dry plate. I would like to know what experiments have been made. After exposing a plate as usual, I want the image to be a positive instead of a negative. A. The photographic image is reversed by greatly increasing the time of exposure. The image then develops as a positive instead of a negative.

NEW BOOKS, ETC.

KNAUER'S MANUFACTURERS OF THE UNITED STATES STANDARD REFERENCE BOOK. New York: The Manufacturers' Red Book Publishing Company, 1905. Large 4to.; pp. 2,700. Price, $15.

The present edition is the fifth of this extremely useful book of reference, which enumerates and classifies the names and addresses of 512,734 American manufacturers and their output of 52,596 different articles. The book itself has grown from a small 46-page pamphlet, weighing 3 ounces (published in 1882) to the present large volume, weighing 12½ pounds. The book is made up largely of lists of manufacturers of all kinds of articles, and after the name of each manufacturer is printed the amount of capital invested in his business. In cases where this information is not stated, any subscriber can obtain it from the publisher upon application. Besides a complete index of articles catalogued in the work, there is a complete list of the export and commission merchants of the United States. The book is brought up to date annually by the addition of an appendix.

SPANISH-ENGLISH DICTIONARY OF MINING TERMS. By Frederick Lucas. London: Technological Institute. 16mo.; pp. 78. Price, $2.

An important book for those who have mining interests in the Spanish-speaking countries.

NATURE STUDY WITH COMMON THINGS. By M. H. Carter. New York: American Book Company, no date. 12mo.; pp. 150.

This is an elementary laboratory manual. The lessons are planned to set forth what a child can learn for himself about a given thing in one hour, not to teach all that is known, or even all that he himself can know by unlimited study upon it. This is not a handbook of information, but a practical classroom guide, intended solely to develop the method of *learning how to learn.* It is an excellent elementary treatise on the subject.

CULTIVATION AND PREPARATION OF PARA RUBBER. By W. H. Johnson, F.L.S., F.R.H.S. London: Crosby Lockwood & Son, 1904. 8vo.; pp. 99. Price, $3.

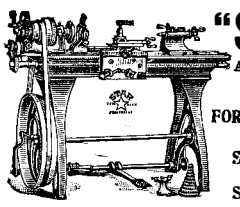
This book is intended to give practical advice to all persons interested in the growing and preparation of Para rubber for market. It is written by a man who has had wide experience and has made a study of the methods employed in Ceylon in cultivating the rubber tree. After describing the Para rubber tree, and its cultivation, the author tells of the insect pests and fungoid diseases to which it is liable, the methods of collecting the rubber, and the preparation of the latter from the latex. The yield of Para rubber from cultivated trees is also discussed, and the closing chapters deal with the establishment and maintenance of a Para rubber plantation, and the commercial value of the oil of hevea seeds.

TWENTY-SEVENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF THE STATE OF CONNECTICUT FOR THE YEAR 1904. With the Registration Report for 1903 Relating to Births, Marriages, Divorces and Deaths. New Haven, Conn.: Tuttle, Morehouse & Taylor Company, 1905. 8vo.; pp. 295.

This book, as usual, is of great interest to all who have to do with the general health of the communities mentioned in it. It contains a number of charts, showing the death rate per thousand, during a considerable number of years, from various common diseases. It also contains the annual reports of the County Health Officers. It is interesting to note that the State Entomologist has made a considerable number of surveys of mosquito-breeding places in the State, prepared topographical maps of these localities, and given instructions to the local authorities for their treatment. Another important service rendered by the Board of Health is the monthly examination of water supplied to the various cities, and the analysis and bacteriological examination of samples of water from wells and springs suspected of being dangerous to the public health. Analyses are also made of sewage effluents in connection with the inspection of sewage purification works made by the Board's inspector.

SUBURBAN HOMES, THEIR ACCESSORIES AND EMBELLISHMENTS. By J. H. Woolfitt. London: Guilbert Pitman, 1905. 16mo.; pp. 122. Price, 50 cents.

This brochure contains directions for making articles of considerable size which will be found both useful and ornamental in one's home. The articles described are a novel hall cabinet, a desk and revolving bookcase for the study, a cabinet bookcase and winter and summer fireplace for the dining room, a combination music seat for the drawing-room, as well as several forms of scroll brackets: a dresser cabinet for the kitchen; a useful shed for the garden, and a semi-rustic and Queen Anne porch for the exterior of the house. Although



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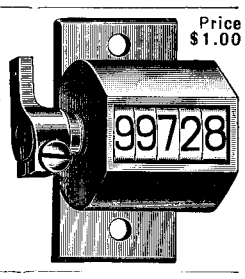

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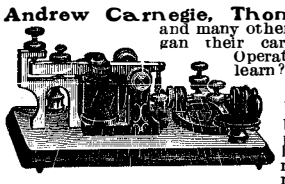

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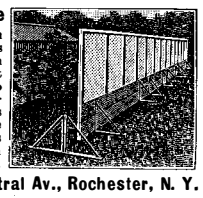

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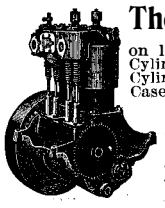

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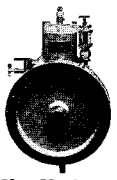

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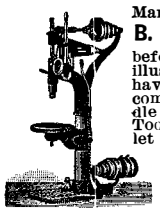

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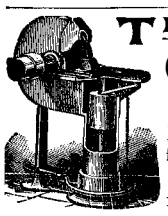

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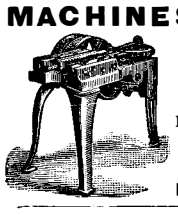

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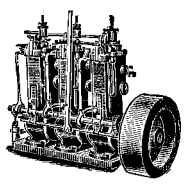

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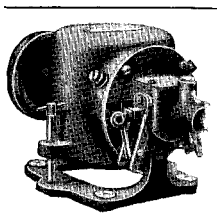

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HINTS TO YOUNG YACHT SKIPPERS. By Thomas Fleming Day. New York and London: The Rudder Publishing Company, 1904. 18mo.; pp. 122. Price, $1.

Mr. Day, than whom there is no more charming and altogether captivating writer on yachts and yachting, has given the public another of his useful Rudder On Series, and like all its predecessors it is practical, compact, and entertaining. These Hints to Young Skippers are answers to just the very kind of questions that the amateur yachtsman wants to know. The book is small enough to be carried in the pocket, or stowed away in the locker or rack with the limited printed matter, in the way of charts, tidal and weather information, which even the smallest knockabout that goes a-cruising carries. The illustrations are half-tones of drawings by Warren Sheppard, and they show the position of the sails and the proper method of handling them on the various points of sailing or under the many critical conditions that arise when on a cruise.

THE FAN. Including the Theory and Practice of Centrifugal and Axial Fans. By Charles H. Innes, M.A. New York: The Van Nostrand Company, 1904. 12mo.; pp. 252; 142 diagrams and illustrations. Price, $2.50.

This book, by the author of "Centrifugal Pumps, Turbines, and Water Motors," is written with the idea that the same theory used in the construction of centrifugal pumps can be applied to fans and blowers. That this is so is shown by numerous experiments described by the author. The book opens with chapters descriptive of the theory of the centrifugal fan, which are followed by experiments and descriptions of various fans or blowers of this type. In the latter part of the book a description is given of Prof. Rateau's high-pressure screw fans, and the theory of these fans is also stated. The theory which governs propeller fans is also discussed. Among the topics treated in the work are chapters on the design of various types of fans and experiments illustrating the action of such types; the variation of pressure in centrifugal fans; and the theory which governs the propeller ventilating fans.

A TREATISE ON THE THEORY OF ALTERNATING CURRENTS. By Alexander Russel, M.A., M.I.E.E. New York: The Macmillan Company, 1904. 8vo.; pp. 407. Price, $5.

This volume is the first of this new work on the theory of alternating currents. In it the more general theorems are collected and proofs are given of the more important of them, due notice being taken of the assumptions that it is sometimes necessary to make. The first part of the book deals with inductance and capacity, and the formulæ there given should be helpful to all practical electricians. In Chapter V. illustrations are given of the methods for calculating the capacities of polyphase cables and overhead wires, and the method of finding the inductances of these combinations of conductors in the case of surface currents is also described. In Chapter IX. the test-room methods of measuring power are given, and when discussing practical problems the author describes the method of replacing an air-core transformer by its equivalent network. Some of the problems in two-phase theory are discussed and how the theorems of solid geometry can be usefully applied to them is shown. The main problems in the theory of phase indicator and induction type watt-hour meters are stated and approximate solutions are given. The theory of rotating magnetic fields is also described as well as the interesting problem of the nature of the magnetic field around parallel wires carrying polyphase currents. Most helpful to the practical worker will be found the approximate solutions of the problem of the eddy currents in magnetic metals. The book is very complete and will be found useful to both the student and the practical man.

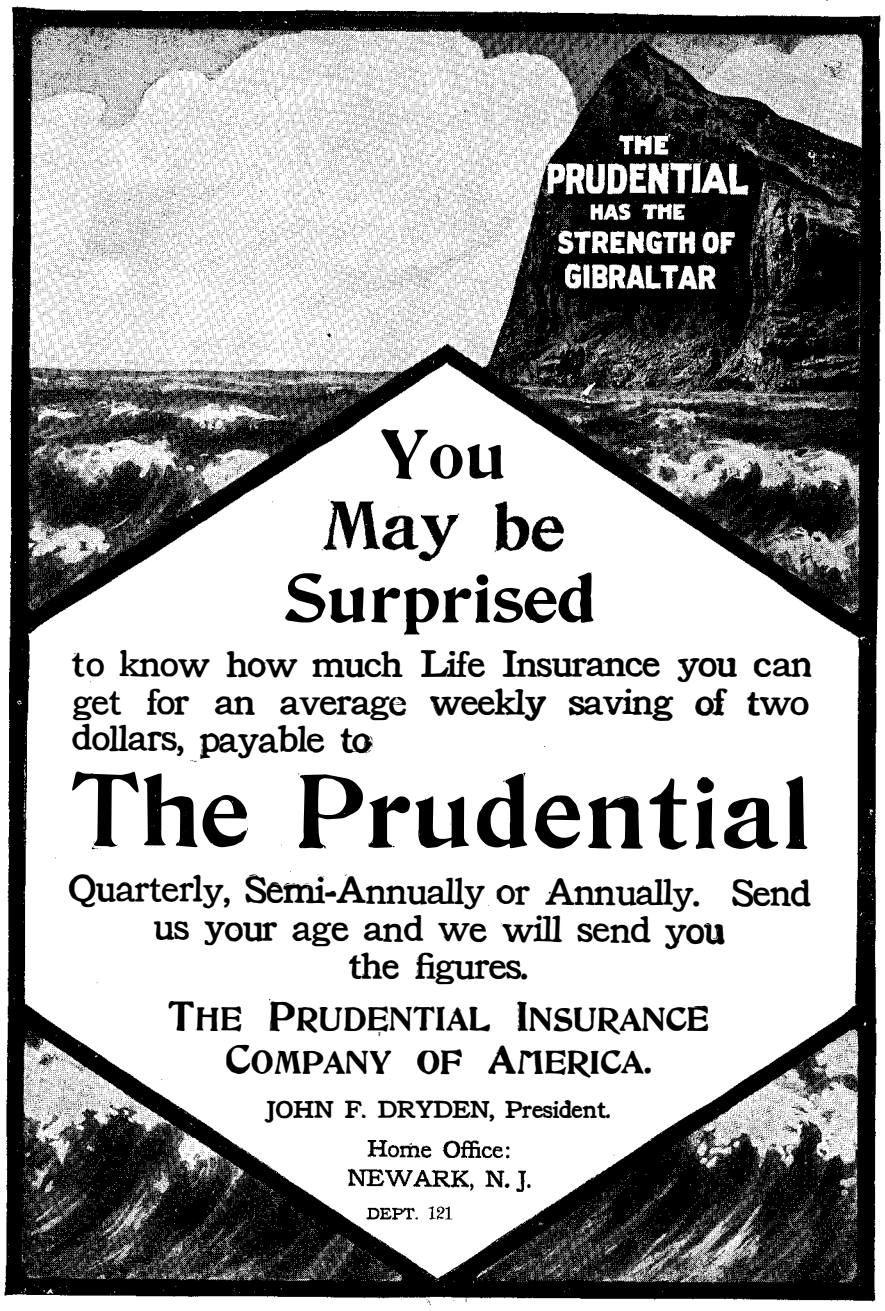
INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 7, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generator, A. Yancey	784,462
Acetylene generator feeding device, A. Yancey	784,463
Advertising button, changeable, Smith & Weinland	784,077
Agar-agar and product of same, manufacturing limpid solutions of, W. Riebensahm.	784,349
Air brake apparatus, C. E. Turner	784,526
Air brake mechanism, H. E. Haddock	784,321
Air brake system, I. M. Simons	784,506
Air regulating and indicating device, compressed, C. H. Richwood	784,228
Air separator and water seal fitting, S. V. Sharood	784,185
Air ship, H. E. Honeywell	784,161



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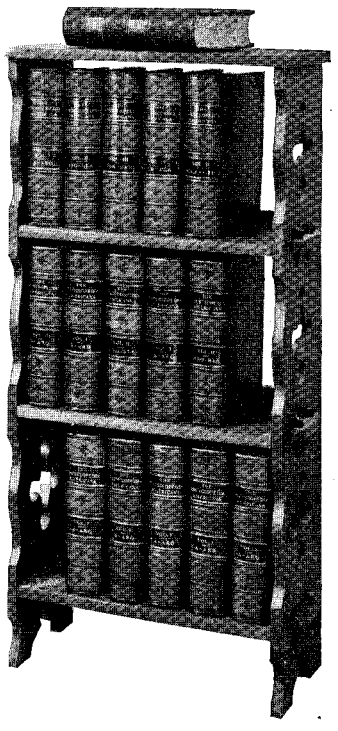

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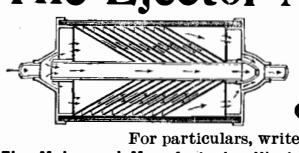

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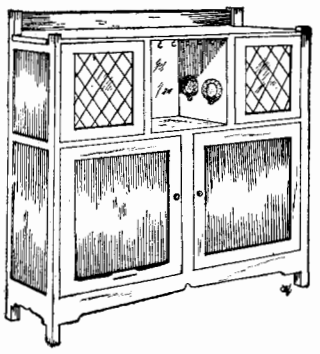

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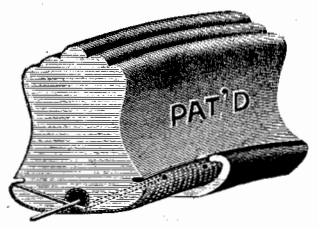

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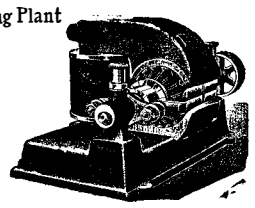

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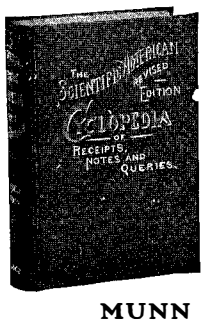

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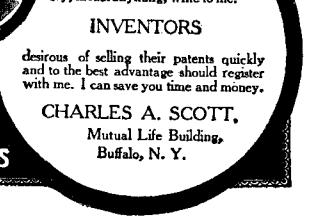

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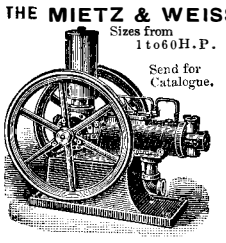

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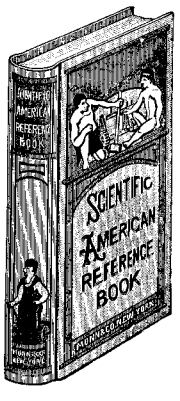

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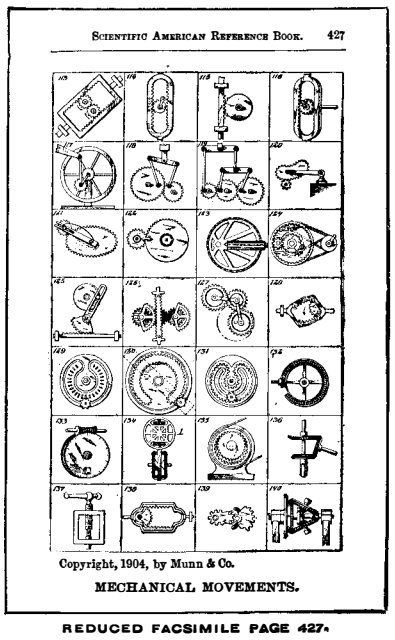

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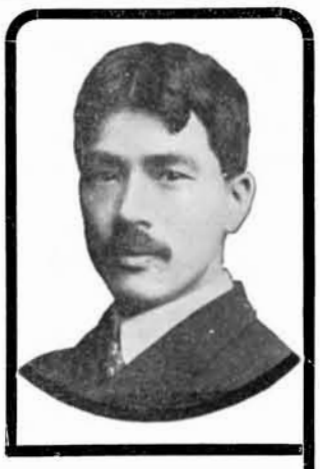

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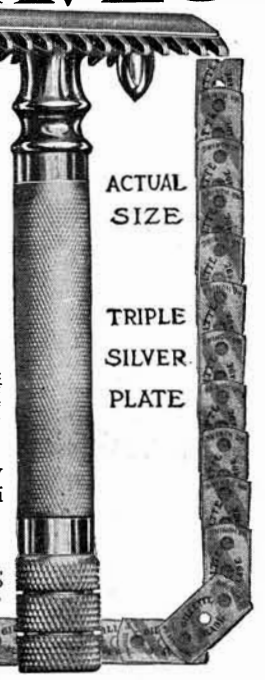

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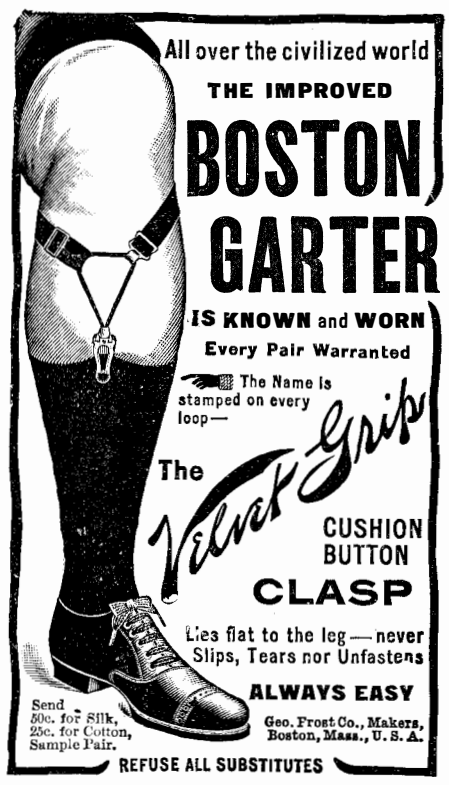

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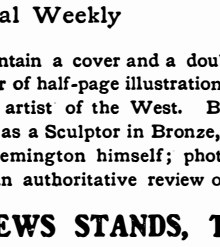
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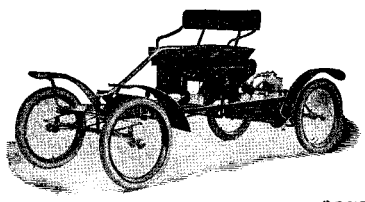

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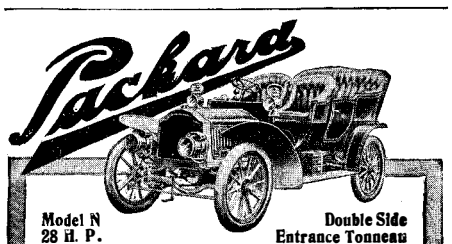

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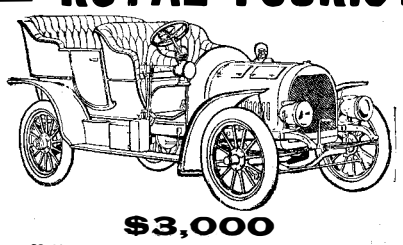

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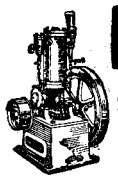

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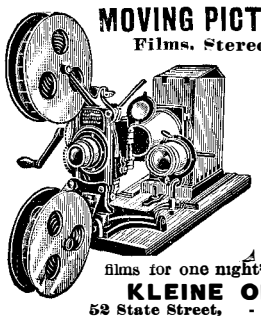

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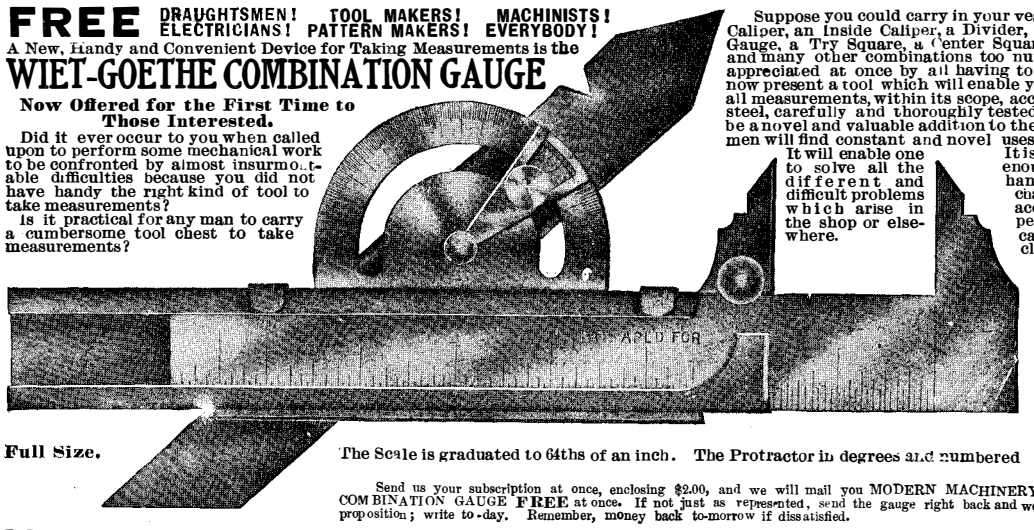

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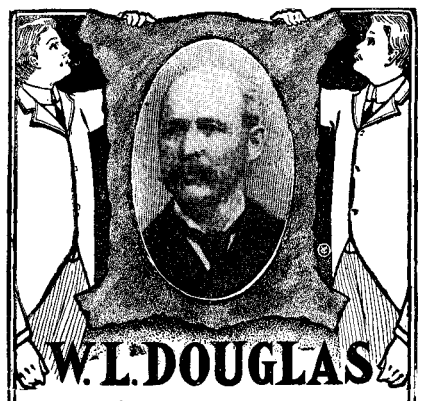

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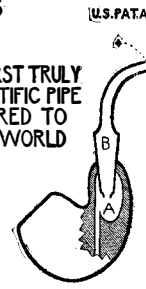

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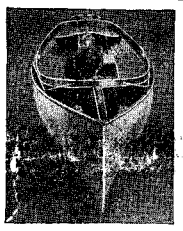

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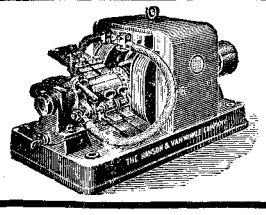

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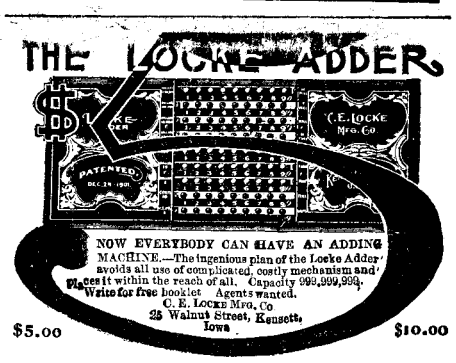

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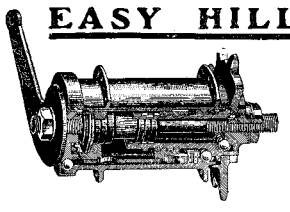

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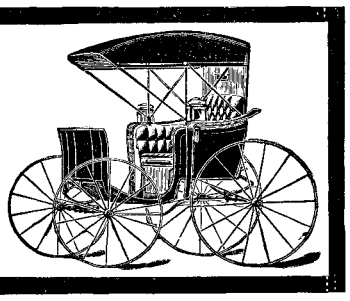

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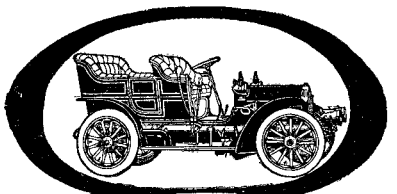

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